

JOURNAL OF e-LEARNING AND KNOWLEDGE SOCIETY

www.je-lks.org

VOLUME 17 | ISSUE NO. 2 | DECEMBER 2021

REGULAR ISSUE

PEER REVIEWED
RESEARCH PAPERS

**AN INTERNATIONAL AND OPEN ACCESS JOURNAL
BY THE ITALIAN E-LEARNING ASSOCIATION**

ISSN (online) 1971 - 8829 | ISSN (paper) 1826 - 6223

JOURNAL OF e-LEARNING AND KNOWLEDGE SOCIETY

www.je-lks.org

VOLUME 17 | ISSUE NO. 2 | DECEMBER 2021

REGULAR ISSUE

**PEER REVIEWED
RESEARCH PAPERS**

**AN INTERNATIONAL AND OPEN ACCESS JOURNAL
BY THE ITALIAN E-LEARNING ASSOCIATION**

ISSN (online) 1971 - 8829 | ISSN (paper) 1826 - 6223

JOURNAL OF e-LEARNING AND KNOWLEDGE SOCIETY

www.je-lks.org - www.sie-l.it

ISSN (online) 1971 - 8829 |ISSN (paper) 1826 - 6223

Je-LKS is an Open Access Online publication. This means that everybody can free access online to abstracts and full t articles.

The Journal is issued online three times per year.

ANVUR Ranking: A-Class for Sector 10, 11-D1 and 11-D2

Libraries or researchers, can subscribe a Printed Copies Service or an Issue Reprint Service.

The Printed Copies Service is on a yearly basis and you can receive the three printed year issues.

The Issue Reprint Service provide five printed copies of a specific issue.

Both the Services have the same cost of 150€ (including taxes).

Shipping costs are not included and will be charged.

In order to subscribe Printed Copies or Issue Reprint Services contact:

email: segreteria@sie-l.it

email: staff@je-lks.org

Tel. +39 0522 522521

website: www.sie-l.it

PUBLISHER AND COPYRIGHT

Italian e-Learning Association (Sie-L)



CONTACTS

editor@je-lks.org

managingeditor@je-lks.org

assistanteditors@je-lks.org

Registration at the Rome Court in the pipeline

ISSN (online) 1971 - 8829

ISSN (paper) 1826 - 6223

EDITOR IN CHIEF

TOMMASO MINERVA

University of Modena and Reggio Emilia, Italy

ASSOCIATE EDITORS

TEL AMIEL

University of Campinas, Brasil

FAWZI BAROUD

Notre Dame University - Louaize, Lebanon

CHERYL BROWN

University of Canterbury, New Zealand

ULF-DANIELS EHLERS

Baden-Württemberg Cooperative State University in Karlsruhe, Germany

PAOLO MARIA FERRI

University of Milano-Bicocca, Italy

ANTONIO MOREIRA TEIXEIRA

UNIVERSIDADE ABERTA - LISBOA, PORTUGAL

FABIO NASCIMBENI

University of La Rioja - Madrid, Spain

ALBERT SANGRÀ

Universitat Oberta de Catalunya, Spain

AHMED TLILI

Beijing Normal University, China

DANIEL VILLAR-ONRUBIA

Coventry University, United Kingdom

ZORAINI WATI ABAS

Wawasan Open University, Malaysia

MARIA C. ZAMORA

Kean University, Union (NJ), USA

MANAGING EDITOR

LUCIANO CECONI

University of Modena and Reggio Emilia, Italy

ASSISTANT EDITORS

CLAUDIA BELLINI

University of Modena and Reggio Emilia, Italy

VALENTINA ELVIRA COMBA

Italian e-Learning Association

ANNAMARIA DE SANTIS

University of Modena and Reggio Emilia, Italy

BOJAN FAZLAGIC

University of Modena and Reggio Emilia, Italy

STEFANO MORIGGI

University of Milano-Bicocca, Italy

VERONICA ROSSANO

University of Bari, Italy

KATIA SANNICANDRO

University of Modena and Reggio Emilia, Italy

NICOLA VILLA

Italian e-Learning Association

SCIENTIFIC COMMITTEE

Adorni Giovanni - University of Genova, Italy;
Bonaiuti Giovanni - University of Cagliari, Italy;
Calvani Antonio - University of Firenze, Italy;
Cantoni Lorenzo - University of Lugano, Switzerland;
Carbonaro Antonella - University of Bologna, Italy;
Cartelli Antonio - University of Cassino, Italy;
Ceconi Luciano - Univ. of Modena-Reggio Emilia, Italy
Cerri Renza - University of Genova, Italy;
Cesareni Donatella - University of Roma, Italy;
Coccoli Mauro - University of Genova, Italy;
Delfino Manuela - C.N.R. I.T.D of Genova, Italy
Dipace Anna - Univ. of Modena and Reggio Emilia, Italy;
Faiella Filomena, University of Salerno, Italy,
Ghislandi Patrizia - University of Trento, Italy;
Guerin Helen - University College Dublin Ireland;
Guerra Luigi - University of Bologna, Italy;
Holotescu Carmen - University of Timisoara, Romania;
Karacapilidis Nikos - University of Patras, Greece;
Karlsson Goran - University of Stockholm, Sweden;
Kess Pekka - University of Oulu, Finland;
Ligorio Beatrice - University of Bari, Italy;
Manca Stefania - C.N.R. I.T.D of Genova, Italy;
Mandl Heinz - Universitat Munchen, Germany;
Mangione Giuseppina Rita, INDIRE, Italy;
Maresca Paolo - University of Napoli Federico II, Italy;
Marzano Antonio - University of Salerno, Italy;
Mich Luisa - University of Trento, Italy;
Michellini Marisa - University of Udine, Italy;
Molinari Andrea, University of Trento, Italy,
Persico Donatella - C.N.R. I.T.D of Genova, Italy;
Pirio Giuseppe, University of Bari, Italy,
Rizzo Antonio - University of Siena, Italy;
Roselli Teresa - University of Bari, Italy,
Sarti Luigi - C.N.R. I.T.D of Genova, Italy;
Trentin Guglielmo - C.N.R. I.T.D of Genova, Italy;

REVIEWERS

Francesco Agrusti, Daniela Amendola, Thanyatorn Amornkitpinoy, Alice Barana, Adalgisa Battistelli, Claudia Bellini, Giovanni Bonaiuti, Beatrice Bonami, Daniela Borissova, Filippo Bruni, Alessia Cadamuro, Gabriella Calvano, Roberto Capone, Antonella Carbonaro, Alessio Cavicchi, Alessio Ceccherelli, Luciano Ceconi, Mauro Coccoli, Francesca D'Errico, Estela Dauksienė, Annamaria De Santis, Pierpaolo Di Bitonto, Luciano Di Mele, Sara Dias-Trindade, Anna Dipace, Gabriella Doderò, Hendrik Drechsler, Ulf Daniel Ehlers, Meryem Erbilek, Filomena Faiella, Laksmi Evasufi Fajari, Bojan Fazlagic, Laura Fedeli, Michele Fedrizzi, Paolo Ferri, Giuseppe Fiorentino, Rita Francese, Carlo Giovannella, Francisco D. Guillen-Gamez, Teodora Hristova, Franco Landriscina, Antonella Lotti, Giuseppina Rita Jose Mangione, Paolo Maresca, Marina Marchisio, Antonio Marzano, Marco Masoni, Azarias Mavropoulos, Rory Mc Greal, Luisa Mich, Sergio Miranda, Andrea Molinari, Stefano Moriggi, Fabio Nascimbeni, Jako Olivier, Gigliola Paviotti, Corrado Petrucco, Maria Chiara Pettenati, Antonella Poce, Giorgio Poletti, Ana Luisa Rodrigues, Alessia Rosa, Veronica Rossano, Lino Rossi, Marina Rui, Margherita Russo, Matteo Sacchet, Katia Sannicandro, Rossella Santagata, Ines Saric-Grgic, Javier Sarsa, Lorenzo Scianatico, Antonio Teixeira, Pham Thach, Admed Tlili, Guglielmo Trentin, Andrea Trentini, Roberto Trincherò, Pietr Van de Craent, Rosa Vegliante, Gianni Vercelli, Nicola Villa

JOURNAL OF e-LEARNING AND KNOWLEDGE SOCIETY

www.je-lks.org

ISSN (online) 1971 - 8829

ISSN (paper) 1826 - 6223

VOLUME 17 | ISSUE NO. 2 | DECEMBER 2021

PEER REVIEWED PAPERS

- PAG. 1 APPLICATION OF PEER REVIEW IN A UNIVERSITY COURSE:
ARE STUDENTS GOOD REVIEWERS?
**Maria Renza Guelfi, Andreas R. Formiconi, Marta Vannucci,
Lorenzo Tofani, Jonida Shtylla, Marco Masoni**
- PAG. 9 ONLINE CLASSES DURING COVID-19 PANDEMIC:
PREPAREDNESS AND READINESS OF STUDENTS AND
TEACHERS IN PAKISTAN WITH PARENTS' EXPERIENCES
Farah Naz Makhdam, Afifa Khanam
- PAG. 21 LEARNING FROM A DISTANCE DURING A PANDEMIC
OUTBREAK: FACTORS AFFECTING STUDENTS' ACCEPTANCE
OF DISTANCE LEARNING DURING SCHOOL CLOSURES
DUE TO COVID-19
**Bobby Ardiansyahmiraja, Reny Nadlifatin, Satria Fadil
Persada, Yogi Tri Prasetyo, Michael Nayat Young,
A. A. N. Perwira Redi, Shu-Chiang Lin**
- PAG. 32 DISTANCE – LEARNING GOES VIRAL: REDEFINING
THE TEACHING BOUNDARIES IN THE TRANSFORMATIVE
PEDAGOGY PERSPECTIVE
Laura Branchetti, Roberto Capone, Maria Laura Rossi

- PAG. 45 FROM TRADITIONAL EXAMS TO CLOSED-ENDED QUIZZES:
AN EXPLORATION TOWARDS AN EFFECTIVE ASSESSMENT
IN MATHEMATICS AT UNIVERSITY LEVEL
Giovannina Albano, Agnese Ilaria Telloni
- PAG. 56 COVID-19 PANDEMIC ENDORSES NEW ERA OF E-LEARNING
CASE STUDY: HASHEMITE UNIVERSITY
**Sahar Idwan, Ebaa Fayyoubi, Haneen Hijazi,
Izzeddin Matar**
- PAG. 66 THE IMPACT OF ONLINE INSTRUCTION INTEGRATED WITH
BRAIN-BASED TEACHING APPROACH
TO EFL STUDENTS WITH DIFFERENT MOTIVATION LEVEL
**Rukminingsih, Januaris Mujiyanto, Joko Nurkamto,
Rudi Hartono**
- PAG. 74 THE INFLUENCE OF THE STUDENT TEAM ACHIEVEMENT
DIVISION MODEL ON COMMUNICATION SKILLS
IN ECONOMICS SUBJECTS
**Nazaruddin Ali Basyah, Marzudi Md Yunus, Irham Fahmi,
Zakaria A. Jalil, Zulfadhli Rusli**
- PAG. 85 THE NEW NORMAL: ONLINE CLASSES AND ASSESSMENTS
DURING THE COVID-19 OUTBREAK
Rizwana Wahid, Oveesa Farooq, Ahtisham Aziz
- PAG. 97 EMPIRICAL EVIDENCE AND RESEARCH PERSPECTIVES ON
THE USE OF DIDACTIC VIDEO:
WITH A FOCUS ON THE HEALTH PROFESSIONS
Giovanni Ganino

Application of peer review in a university course: are students good reviewers?

Maria Renza Guelfi^a, Andreas R. Formiconi^b, Marta Vannucci^c,
Lorenzo Tofani^a, Jonida Shtylla^a, Marco Masoni^{a1}

^aUniversity of Florence, Dept. of Experimental and Clinical Medicine – Florence (Italy)

^bUniversity of Florence, Dept. of Statistics, Informatics and applications – Florence (Italy)

^cCareggi University Hospital, Dept. of Maternity and Child Health – Florence (Italy)

(submitted: 9/10/2020; accepted: 2/11/2020; published: 15/10/2021)

Abstract

Peer review can be used as a teaching methodology to improve students' learning and critical thinking. However, teachers have many concerns about the reliability and validity of students' grading.

The paper describes the application of peer review as a teaching strategy to the large course of Biomedical Informatics in the School of Medicine at the University of Florence. The aim of the study was twofold: (I) assessing the validity of students' reviews, calculating the correlation between students' assigned score and instructor's assigned score; (II) assessing the validity of student's self-evaluation, calculating the correlation between student's assigned score and teacher's assigned score. To this aim a statistical analysis was performed.

The results showed a moderate concordance between the marks assigned by peers and those assigned by the instructor. Nevertheless, the comparison between the teacher median and the peer-review median shows a minimal difference that has almost no effect on changing the final grade. Instead, there was poor concordance between the marks attributed by the instructor and those relating to the student's self-evaluation. Even if further studies are needed, the promising results can begin to dispel teachers' concerns about students' grading skills that prevent the application of peer review. On such basis, the use of peer review systems can streamline the application of peer review in classes with a high number of students reducing the workload on the teacher.

KEYWORDS: Peer assessment; Peer review, Self assessment, Higher Education, Medicine, Peer Assessment Validity

DOI

<https://doi.org/10.20368/1971-8829/1135380>

CITE AS

Guelfi, M.R., Formiconi, A.R., Vannucci, M., Tofani, L., Shtylla, J., & Masoni, M. (2021). Application of peer review in a university course: are students good reviewers? *Journal of e-Learning and Knowledge Society*, 17(2), 1-8.

<https://doi.org/10.20368/1971-8829/1135380>

1. Introduction

Peer assessment is an educational strategy that requires learners to evaluate their peers based on criteria provided by the teacher (Topping, 1998). Peer assessment can be applied in different ways. Among the

different options available, it is frequently used the double blind peer review process, the established procedure that provides quality control in the production and progress of scientific knowledge.

In the educational context the peer review process implies that students evaluate and make judgment on the works of peers producing feedback reviews. At the same time students receive feedback reviews on their own work (Nicol et al., 2014).

As defined before, peer review represent a solution to act on learning through a double feedback process in which the students' works represents the basis on which reflections and judgements are made. When producing feedback, a self-evaluation process is made by students, that compares works of peers with their own. At the same time works of peers are compared to each others

¹ corresponding author - email: m.masoni@med.unifi.it

to produce feedback reviews that must take into account the criteria given by the teacher (*ibid.*). The self-evaluation process is considered very useful to facilitate the development of critical thinking which in turn will be central in lifelong learning and in the exercise of the professional activity (Geithner & Pollastro, 2016).

When receiving feedback reviews students are alerted about errors or gaps as well as misinterpretations contained in their own work. The suggestions of peers stimulate a critical thinking that leads to a reanalysis and revision of the initial work. If there is enough time in the course a self-review phase is highly recommended, as it allows students to immediately apply new ideas and different perspectives as well as to improve their writing skills (*ibid.*).

Many researchers argue that peer-review stimulates the development of student's evaluation skills that are usually ignored in traditional education. Cited benefits are (Mulder et al., 2012; Pelaez, 2002; Timmerman & Strickland, 2009):

- exposure to different perspectives in the analysis of a topic;
- development of critical thinking and problem solving skills;
- better attitude toward science;
- greater students' responsibility for their own learning.

For the rest of the paper it is useful to define the concepts of reliability and validity of peer assessment that are often misreported in the literature. Reliability is a variable that can be calculated by the consistency of marks given by peers. Validity is a variable that can be measured by the convergence between the students assigned marks and the teacher assigned mark (Bouzidi & Jaillet, 2009).

Feedback is a time consuming activity, but it is considered a crucial issue to enhance students' learning (Higher Education Funding Council for England, 2011). To provide feedback from peers is seen as an alternative to instructor's feedback and it can be useful to reduce teacher's workload, especially in courses with a high number of students. However, there are criticisms on peer-review as a teaching methodology.

One of the main issue of concern is the poor reproducibility and validity of student generated grades: in addition to having a poor knowledge of the discipline, they have rarely carried out review activities so the reliability of their evaluations could be poor (Cho et al, 2006). Others draw attention to the possible distortions resulting from friendships and deals between students (*ibid.*). In the latter case, the double-blind review allows to overcome the problem, since the student does not know the identity of the authors of the papers to be reviewed, nor of those who will review the one produced by him (Guelfi et al., 2019).

On the other hand, there are reasons to believe that peer assessment can be just as good as that of the teacher. In the first place, the latter may have reliability problems due to the high number of documents that he has to examine with the need to speed up the evaluation process. This situation does not occur in students peer review, where each one has a small number of papers to review which they can spend more time on. Secondly, a single paper is analyzed by several learners and the reliability of the set of assessments could be higher (Cho et al., 2006). Thirdly, the higher number of received feedbacks than those of the teacher can give a broader view of the topic (Topping, 1998). Finally, students' feedback reviews can be written in a more accessible way.

Applying peer review is a time consuming process, especially when teachers have classes with a high number of students. In this case it is crucial to have a peer review system, an educational tool that streamlines peer assessment implementation and reduces the teacher's workload. Peer review systems allow students to upload papers and then to distributes them randomly and anonymously, assigning each student the papers to be reviewed.

There are many peer review systems now available. Calibrated Peer Review (CPR) is a widely used program developed at UCLA that allows to hone ("calibrate") students' evaluation skills with sample assignments comparing their ratings to those assigned by the instructor (Robinson, 2005). CPR has been successfully used in hundreds of educational organizations all over the world. Moodle is a widespread Learning Management System that has a module, named Workshop, to manage peer review. Moodle workshop has been tested and it represents a reliable technology for peer review (Strang, 2015).

Higher education represents a context where large classes are common and peer review is frequently applied as a teaching methodology to enhance learning (Luckner & Purgathofer, 2015). Several studies have been published in the literature that used the peer-review process in the biomedical area.

In biology courses, B. Timmerman and D. Strickland (2009) have shown that not only graduated students but also undergraduates can be effective peer reviewers and that peer review improves reasoning skills, scientific writing and attitudes towards science. In a human physiology program, it has been demonstrated that peer review is one of the most effective learning activities that enhance students' perception of their scientific literacy and writing skills (Geithner & Pollastro, 2016). In a Doctor of Pharmacy curriculum, the inter-rater reliability of students' evaluations versus faculty evaluations was assessed through the CPR system. The results showed a fair inter-rater reliability between

scores assigned by pharmacy students and faculty members (Isaacs et al., 2020).

The assumption at the basis of this study is that the teacher is a reliable assessor. Instead, the literature reports many concerns about student's assessment skills. The focus of the study is to answer the question if students can be reliable reviewers as good as the teacher.

The article describes an experiment conducted in a large course at the School of Medicine of the University of Florence where peer review as a teaching strategy was applied. The aim of the study was twofold:

- assessing the validity of students' reviews, calculating the correlation between scores assigned by peers and those assigned by the teacher;
- assessing the validity of student's self-evaluation, calculating the correlation between student's assigned score and teacher's assigned score.

2. Materials and Methods

The study was conducted in the 2018/19 academic year in the course of Biomedical Informatics at the School of Medicine of the University of Florence. The course assigns 3 credits and takes place in the second semester of the first year of the medical degree.

It was delivered over nine weeks in blended learning mode, with about 60% of the teaching activities carried out remotely by Moodle and the Massive Online Open Course (MOOC) platform Federica of the University Federico II of Naples. The MOOC used in the course was entitled "Il Web e la ricerca di informazioni in rete" and it was developed by MRG and MM.

The face-to-face lessons were highly interactive by means of a Student Response System. These lessons were held one day a week and lasted for 4 hours. Between one face-to-face meeting and the next, a series of learning activities were carried out remotely using Moodle. The distance learning activities, which were mandatory in order to pass the final exam, were tracked and analyzed. The topics covered by the course were finalized to the production of a paper.

At the end of the course the peer-review process was applied. To the students were asked to:

- produce an individual paper on a topic chosen by the instructor;
- review and evaluate five papers produced by peers (peer review) by means of criteria provided by the teacher (rubric);
- then to evaluate its own paper applying the same rubric.

After the completion of the final work a face to face lesson discussed pros and cons of peer review and possible areas of improvement.

To carry out these activities, the Moodle Workshop module was used, an essential tool to automate and speed up process management.

The study cohort consisted of 330 students. The peer-review and the self-assessment activities were carried out by 95.10% of the students.

As showed during the face-to-face lessons, the student's work starts from a clinical scenario to be transformed into a searchable clinical question. The clinical scenario had to be an original student's idea, taking into account the novice knowledge possessed by the first year medical students. The clinical question had to be structured following the PICO model, a paradigm of Evidence Based Medicine. Then, after a PubMed subject search, the student had to choose the correct type of study to answer the clinical question, arguing it on the basis of the pyramid of evidence (Greenhalgh, 2014).

To produce the paper, the student had a maximum time of 10 days available, after which the essay had to be uploaded to the platform without putting one's name and surname and without identification marks in order to make it possible to maintain anonymity in the peer review activity. After the papers delivery phase, the Moodle Workshop module distributed them randomly and anonymously, assigning each student five documents to review (*Double blind peer review*). Each student was also asked to evaluate their own paper. The review phase was to be completed within 14 days. The double-blind peer review eliminates possible bias resulting from agreements between students.

The choice of 5 reviews to be performed by each student was highly considered. Some researchers have argued that from 5 to 7 reviews are the ideal number to increase the level of validity of the reviews themselves and they allow the authors to learn by comparing the opinions received (Cho et al, 2006).

To facilitate peer review and to guide students through the evaluation process rubrics are used. Rubrics are criteria-based marking schemes that raise the quality of assessment helping students to provide and receive standard feedbacks (Jones et al., 2017). Rubrics allow assessors to establish criteria and to define level of performance for each criterion. A rubric is usually presented as a table with criteria in the rows and rating with performance level in the columns.

In the study, the assignment has been divided in four detailed criteria: choice of keywords, PICO model, Pubmed subject search, choice of type of study. Every row of the rubric contains a criterion. The right column contains the scale range for each criterion, Unfortunately, it has not been possible to define precise

levels of performance for each rating due to the wide variety of errors that could be made by students. To overcome the problem, many examples of correspondence between errors and scores for each criterion were shown during the face-to-face lessons.

Table 1 shows the rubric used in the study with four evaluation criteria and, for each criterion, the scale range that reviewers can assign.

CRITERIA	SCALE RANGE
Correct Keywords choice	0-1
Transforming clinical question into a PICO model	0-4
Pubmed subject search	0-2
Choice of appropriate type of study related to the clinical question	0-3

Table 1 - The rubric used in the study.

To dispel students' doubts about the reliability of the reviews received from peers, each paper was evaluated by the teacher. The teacher's evaluation was essential to compare marks assigned by peers and the instructor's rating.

The final grade of the exam was calculated by adding:

- the scores acquired in the activities carried out on the e-learning platform during the course delivery (*maximum 11 points*);
- the teacher's score given to the student's paper (*maximum 10 points*);
- the score that measures the students' ability in evaluating the papers produced by peers and their own. The score was calculated by the algorithm implemented in Moodle Workshop that takes into account, for each paper reviewed, the difference between the teacher's mark and the student's mark for each criterion (*maximum 10 points*).

Each student's paper was assigned a teacher's mark expressed in tenth, a mark (in tenth) given by each of the five reviewers in addition to that assigned by the student himself. A statistical study was carried out in which teacher's evaluation, peers' evaluation and self-evaluation were compared.

Preliminarily, the main tests (Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises and Anderson-Darling tests) to assess the normality of the three mark distributions were applied to the collected data: in the case of a test with a p-value < 0.05, the assumption of normality was refused. According to the results of the preliminary tests, normal distributions using Student-T test, and non-normal distributions using Wilcoxon signed rank Test were compared. The Lin's concordance correlation coefficient to test the agreement between teacher's marks and marks derived

by the peer-review process, and between teacher's marks and self-assessment marks was used. A p-value less than 0.05 is considered statistically significant.

An Excel spreadsheet was used to perform this analysis. Each student was anonymized and identified with a progressive serial number. For each student, three values were recorded: the mark assigned to the student's paper by the teacher; the average mark assigned to the students by the peers at the end of the peer-review process; the self-assessment mark, assigned by the student to his own paper. All marks were expressed in tenth (*minimum 1, maximum 10*) and represented as a continuous numerical variable; for each numerical variable, mean, median and standard deviation (SD) were reported.

3. Results

The relationship between the teacher's marks and the average marks derived by the peer-review process is represented by the scatter-plot in Figure 1.

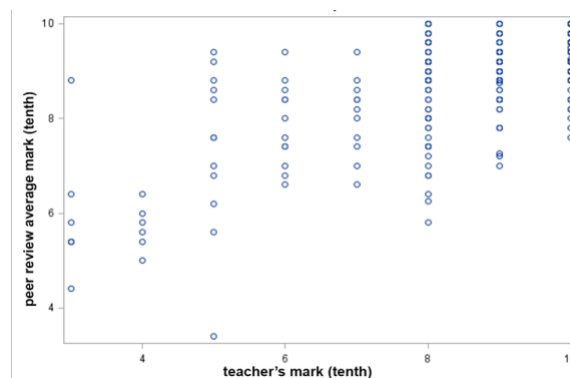


Figure 1 - Scatter-plot showing relationship between "teacher's mark", on the abscissa axis, and "peer review average mark", on the ordinate axis, for each student.

The box-plot in Figure 2 represents the distributions of the three variables "teacher's mark", "peer-review" and "self-assessment": the thick line represents medians.

Considering the first two distribution, the descriptive statistics are the following: "teacher's mark" mean 8.74 (SD 1.69), median 9 versus "peer-review" mark mean 8.89 (SD 1.12), median 9.2; the difference between the two means of the distributions is -0.15.

Table 2 shows the results of normality tests applied to the distributions "teacher's mark" and "peer-review": all the four tests (Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises and Anderson-Darling) give a Statistica test resulting in a p<0.05; then, the hypothesis of normality of the distributions was not accepted, and, for the following comparison the non-parametric Wilcoxon signed rank test was used (Table 3).



Figure 2 - Boxplot of the three distributions: “teacher’s mark”, “peer-review” mark and “self-assessment” mark.

Considering data showed in Figure 2 and Table 3, it is clear that there is a significant difference between the two distributions: the evaluation of the students tended to be higher than that attributed by the teacher. Nevertheless, as we can see comparing the medians (“teacher’s mark” median 9.0 and “peer-review” median 9.2), this difference is minimal and has no practical impact in modifying the final mark for the course.

The bar-plot in Figure 3 displays the absolute frequencies (in ordinate axis) of the differences, for each student, between the teacher’s mark and the average mark derived from the peer-review process: it is clear that more than 70% of the differences in the order of ± 1 compared to the teacher’s mark.

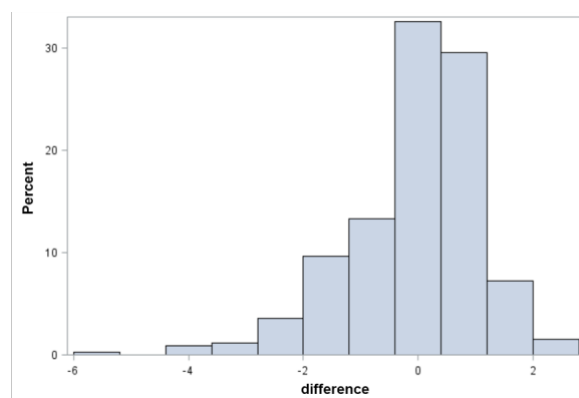


Figure 3 - Frequencies of differences between “teacher’s mark” and “peer-review” mark, for each student of the study sample.

Figure 4 presents the Lin’s concordance coefficient, expressed as mean and 95% confidence interval; this analysis has been conducted considering every single mark as a discrete numerical variable.

As proposed by McBride G. B. (2005), the Strength-of-Agreement between two discrete numerical variables can be evaluate as follows:

The aim of this study is to evaluate, for each paper, the concordance between:

1. Almost perfect: Lin’s concordance correlation coefficient > 0.90 ;
2. Substantial: $0.8 < \text{Lin’s concordance correlation coefficient} \leq 0.9$
3. Moderate: $0.65 \leq \text{Lin’s concordance correlation coefficient} \leq 0.8$
4. Poor: Lin’s concordance correlation coefficient < 0.65

Test	Statistica	P-value
Shapiro-Wilk	W 0.930093	< 0.0001
Kolmogorov-Smirnov	D 0.169882	< 0.0100
Cramer-von Mises	W-Sq 1.410353	< 0.0050
Anderson-Darling	A-Sq 7.172708	< 0.0050

Table 2 - The normality tests for the two distributions: “teacher’s mark” and “peer-review” mark.

Test	Statistica	P-value
Student’s T	T -25.5886	< 0.0001
Sign	M -148.5	< 0.0001
Signed Rank	S -27115.5	< 0.0001

Table 3 - Wilcoxon Signed Rank test for comparing the two distributions, “teacher’s mark” and “peer-review” mark; the first row shows the result of Student T-test for the same distributions.

Considering our lower one-side 95% confidence limit (0.6571), we can conclude that there is a moderate concordance between the teacher’s mark and the marks derived by the peer-review process.

The same analyses were carried out to assess the concordance between the teacher’s mark and the student’s self-assessment mark. In this case, the differences are wider: “teacher’s mark” mean 8.74 (median 9) versus student’s “self-assessment” mean 9.62 (median 10). As showed in Figure 5 and 6, not only the difference between “teacher’s marks” and “self-assessment marks” is wider than that presented in the previous analysis, but also this difference is greater than 2 in about 30% of cases.

<u>Lin's concordance coefficient</u>	<u>LCL 95%</u>	<u>UCL 95%</u>
0.6594	0.6571	0.6618

Figure 4 – Lin’s Concordance Correlation Coefficient for the two distributions (“teacher’s mark” and “peer review” mark). LCL 95%: lower one-side 95% confidence limit; UCL 95%: upper one-side confidence 95% confidence limit.

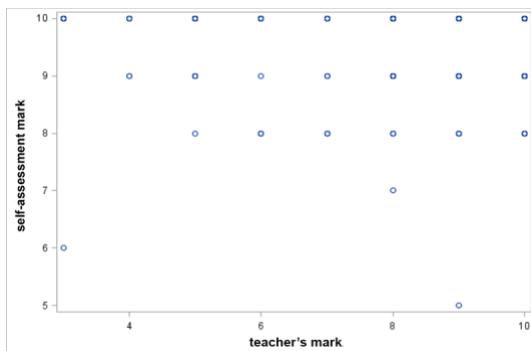


Figure 5 - Relationship between “teacher’s mark” and “self-assessment” mark distribution. it should be noted that low marks of the teacher correspond to high marks of self-assessment.

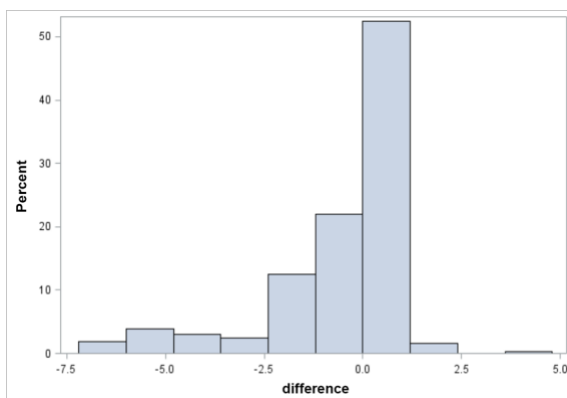


Figure 6 - Barplot showing the frequencies of the differences between the “teacher’s mark” and the “self-assessment” mark for each student.

In the case of the student’s self-assessment, a lower one-side 95% confidence limit of 0.085 indicates only a poor concordance (Figure 7).

<u>Lin's concordance coefficient</u>	<u>LCL 95%</u>	<u>UCL 95%</u>
0.087	0.085	0.088

Figure 7 – Lin’s Concordance Correlation Coefficient for the two distributions (teacher’s mark and “self-assessment” mark).

4. Discussion

The assumption behind the study is that the teacher is a reliable assessor, while there are concerns about the student’s skills both in peer grading and self-evaluation.

The first aim of the study is to determine whether students can be considered valid evaluators as good as the teacher. To address this issue the validity of students’ reviews has been assessed, calculating the correlation between peers’ scores and teacher’s score. The study demonstrated a moderate concordance between the marks assigned by peers and the marks assigned by the teacher (Figure 4). Nevertheless, as seen in Figure 2, the comparison between the teacher median (9.0) and the peer-review median (9.2) shows a minimal difference that has almost no effect on changing the final grade. This issue reinforces the results of the study.

In the literature it is reported that from four to six reviewers is an adequate number to obtain a result of agreement between the marks assigned by the teacher and those of the students (Cho et al, 2006). In the study, choosing five reviewers for each paper contributed to the satisfactory results.

In the literature there are few articles about the use of peer review in health profession education. As cited in the introduction, peer review approach was used in a Doctor of Pharmacy curriculum to assess the inter-rater reliability of students’ evaluations versus faculty evaluations. The results showed a fair inter-rater reliability between scores assigned by pharmacy students and faculty members (Isaacs et al., 2020). The experiment was conducted with the CPR system.

Another study used the same educational tool in third-year medical students. It examined the effectiveness of CPR to teach and assess students’ patient note-writing skills using three longitudinal activities. (McCarty et al., 2005). The results showed a progressive improvement of the student’s CPR activity. The best

alignment between students' scores and faculty scores emerged in the last activity.

For the application of peer review this study used Moodle's Workshop, that do not have a calibration phase of student's grading skills. It is possible that different results would have been obtained with the CPR system.

The second aim of the study was to assess the validity of student's self-evaluation, calculating the correlation between student's score and teacher's score. The results of the study showed poor concordance between the marks assigned by the teacher and those relating to the students' self-evaluation (Figure 7). This is confirmed by Figure 5, where it can be seen that students' marks are higher than teacher marks.

Probably the students do not have enough content knowledge and metacognitive skills to carry out evaluation of their own paper. Another possible explanation of these data is a cognitive process called self-prophecy bias, where students tend to overrate their own performance (Strang, 2015).

From these results it emerges that self-evaluation is less valid than peers evaluation. These data are confirmed in another study (Cho et al, 2006). As consequence, the Authors will exclude self-evaluation from the calculation of the final grade in future studies.

The adoption of new teaching strategy can have benefits that go beyond the single course involving other faculty members. The promising results of the study promoted the implementation of the same teaching methodology in the first year course of Biology at the School of Medicine at the University of Florence.

4.1 Limits of the study

The study focused on the validity of the peer-review process. As consequence, the effectiveness of a teaching strategy based on peer-review on student learning was not considered.

The peer review cycle involves a self-review phase where students update and resubmit the assignment. This phase is highly recommended, as it allows students to immediately apply new ideas and different perspectives (Geithner & Pollastro, 2016). Unfortunately, the time constraints of the course prevented the application of this phase.

Many researchers suggest that giving feedbacks with marks and comments facilitate the evaluation of the teacher and give better learning results than using only marks (Nicol et al., 2004). In the study the high number of students prevented the use of comments due to the high teacher workload.

The reliability of the rubric and the clarity of teacher's presentation on illustrating its use are variables that

greatly affect the validity of the peer review process (Bouzidi & Jaillet, 2009).

At the end of the course during a plenary discussion some students suggested a change to the rubric. They asserted that it was difficult to extrapolate the correctness of the choice of keywords from the construction of the PICO model with a consequent uncertainty in assigning the correct grade. The teachers accepted this suggestion by simplifying the rubric for the following academic year in such a way as to divide the analysis of the work on the basis of three criteria: PICO model, Pubmed subject search, choice of type of study. Consequently, a change in the scale range of the criteria was done.

At the end, no gender difference was considered which could have provided further information.

5. Conclusions

Peer review seems a viable teaching methodology to improve students' learning and critical thinking. The use of peer review systems also makes it possible to apply this teaching strategy to classes with a high number of students, thus reducing the teaching load on the instructor redirecting part of the work to the students.

From the perspective of the teacher concerns exist about the reliability and validity of peer grading assignment. The results of the study have demonstrated a moderate concordance between the marks assigned by peers and the marks assigned by teacher. On such basis, concerns have not to prevent the application of peer review in higher education, at least with appropriate scaffolding.

Given that the concordance is moderate, further studies are needed to evaluate the application of peer review as a teaching methodology in the medical area. However, the current work demonstrate that peer review seems a promising approach to be used in the field of medical education as innovative teaching strategy.

Acknowledgements

The Authors thank Dr. Fabio Picciafuochi of the Department of Anesthesiology, Neuroanesthesia and Intensive Care, Careggi University Hospital (Florence) for the helpful translation tips.

References

- Bouzidi L., Jaillet A. (2009), Can Online Peer Assessment be Trusted?, *Educational Technology & Society*, 12 (4), 257-268.
- Cho K., Schunn C. D., Wilson R.W. (2006), Validity and Reliability of Scaffolded Peer Assessment of Writing From Instructor and Student Perspectives. *Journal of Educational Psychology*, 98, 891-901.
- Geithner C.A., Pollastro A.N. (2016), Doing peer review and receiving feedback: impact on scientific literacy and writing skills. *Adv Physiol Educ*, 40, 38-46.
- Greenhalgh T., eds (2014), *How to read a paper. The basics of Evidence Based Medicine*. Wiley Blackwell V edition.
- Guelfi M.R., Masoni M., Shtylla J., Formiconi A.R. (2019), Peer assessment nell'insegnamento di Informatica del Corso di Laurea in Medicina e Chirurgia dell'Università di Firenze. Firenze, Firenze University Press.
DOI: 10.36253/978-88-6453-890-7
- Higher Education Funding Council for England (2011), *The National Student Survey: Findings and Trends 2006–2010*. Bristol: Higher Education Funding Council for England.
- Isaacs A. N., Miller M. L., Hu T., Johnson B., Weber Z. A. (2020), Inter-Rater Reliability of Web-Based Calibrated Peer Review within a Pharmacy Curriculum. *American journal of pharmaceutical education*, 84(4), 7583.
- Jones L., Allen B., Dunn P., Brooker L. (2017), Demystifying the rubric: a five-step pedagogy to improve student understanding and utilization of marking criteria. *Higher Education Research & Development*, 36:1, 129-142.
DOI:10.1080/07294360.2016.1177000
- Luckner N., Purgathofer P. (2015), Exploring the use of peer review in large university courses. *IxD&A*, 25: 21-38.
- McBride G.B. (2005), A Proposal for Strength-of-Agreement Criteria for Lin's Concordance Correlation Coefficient. NIWA (National Institute of Water & Atmospheric Research) Client Report: HAM2005-062.
- McCarty T., Parkes M. V., Anderson T. T., Mines J., Skipper B. J., Grebosky J. (2005), Improved patient notes from medical students during web-based teaching using faculty-calibrated peer review and self-assessment. *Acad Med*, 80(10 Suppl), S67-70.
DOI: 10.1097/00001888-200510001-00019
- Mulder R., Pearce J., Baik C., Payne C. (2012), Guide to student peer review. URL: <http://peerreview.cis.unimelb.edu.au/wp-content/uploads/2012/06/Academic-guide-FINAL.pdf> (ver 25/08/2021).
- Nicol D., Thomson A., Breslin, C. (2014), Rethinking feedback practices in higher education: a peer review perspective. *Assessment & Evaluation in Higher Education*, 39:1, 102-122.
- Pelaez N.J. (2002), Problem-Based Writing with peer-review improves academic performance in Physiology. *Adv Physiol Educ*, 26, 174-184.
- Robinson R. (2001), Calibrated Peer Review™ an Application to Increase Student Reading & Writing Skills. *The American Biology Teacher*, 63(7), 474-480.
- Strang, K.D. (2015), Effectiveness of peer assessment in a professionalism course using an online workshop. *Journal of Information Technology Education: Innovations in Practice*, 14: 1-16.
- Timmerman B., Strickland D. (2009), Faculty should consider peer review as a means of improving students' scientific reasoning skills. *J Sc Acad Sci* 7: 1.
- Topping, K. (1998), Peer assessment between students in colleges and universities. *Rev Educ Res* 68, 249–276.

Online classes during Covid-19 pandemic: preparedness and readiness of students and teachers in Pakistan with parents' experiences

Farah Naz Makhdam^{a,1}, Afifa Khanam^a

^aLahore College for Women University, Dept. of Education – Lahore (Pakistan)

(submitted: 19/10/2020; accepted: 27/10/2021; published: 10/11/2021)

Abstract

In an attempt to successfully teach students online during a pandemic, it is imperative to investigate to what extent students and teachers are prepared and ready for the adoption of such an approach, as it is difficult to change the educational scenario in Pakistan. The objective of this paper was to identify the degree of readiness and preparedness of students and teachers for implementation of online classes in a crisis situation together-with the experiences of students, teachers and parents in application of online classes during COVID-19. A self-developed online questionnaire, having three separate segments, one each to collect data from students, parents and teachers of private primary and secondary schools of Punjab was used. A sample of size 262 (students 112 teachers 76 and parents 74) was selected through convenient sampling technique. Statistical data analysis, both descriptive (frequencies and percentages) and inferential (Chi-square), was done. The study indicated lack of availability of smooth and fast Internet access at home. Students were required to learn their roles of self-management, to troubleshoot technological issues online without parental assistance and be able to complete their tasks independently. Majority of the parents agreed on temporary continuation of online sessions by schools. This study provides a comprehensive understanding of students and teachers' role, together-with parents' experience, in online sessions and discusses the possibilities of using technologies in education as it depicts the degree and key traits of online sessions for students and teachers needed for readiness and preparedness by private schools during pandemic.

KEYWORDS: COVID-19, Online Classes, Pakistan, Preparedness, Readiness.

DOI

<https://doi.org/10.20368/1971-8829/1135386>

CITE AS

Makhdam, F.N., & Khanam, A. (2021). Online classes during Covid-19 pandemic: preparedness and readiness of students and teachers in Pakistan with parents' experiences. *Journal of e-Learning and Knowledge Society*, 17(2), 9-20.

1. Introduction

Coronavirus disease 2019 (COVID-19) arose from Wuhan (Hubei Province, China) in December 2019 (Li, Liu, Yu, Tang & Tanga, 2020). The World Health Organization declared a pandemic on 21 March 2020 and is spreading rapidly worldwide. Countries in Asia, Europe, the Middle East, and the USA have taken

drastic actions to alleviate it (Junus, Santoso, Putra, Gandhi, Siswantining, 2021). The exponential increase in the number of Covid-19 cases has led to lockdowns worldwide and has prompted the immediate school closures of all education sectors worldwide. The impact of (COVID-19) on education in Pakistan has been profound. Velloso (2020) revealed in a report that about 90% of countries have closed schools due to the spread of COVID-19. Such situations give us a glimpse of how education can change for the better or worse in a lockdown. Students began to learn at home in February 2020 in Hong Kong, through open-source interactive tools, whereas 120 million Chinese students obtained access to learning materials through live television transmission (Tam & El-Azar, 2020). The COVID-19 pandemic is provoking many schools to adopt online classes suddenly to preserve and continue educational processes during this crisis. Teachers, parents, and students are working to accommodate this massive

¹ corresponding author - email: fmakhdam121@gmail.com – address: 121-B-Block, New Muslim Town, Lahore (Pakistan)

change. Educational stakeholders are learning how to cope with the challenge of studying at home and to building a productive schedule outside the school environment. At present, 1.2 billion students in 186 countries have been affected by school closures because of COVID-19 (Li & Lalani, 2020). They further stated, in Denmark, children up to 11 years of age are returning to school after they closed on 12 March 2020, but, in South Korea, students are responding to their instructors online. Since the beginning of March 2020, there have been multiple announcements of the closing of all types of educational institutions and moving instead to online and “remote” education. Furthermore, some institutions have opted to cancel examinations and others have delayed school or university admissions. Likewise, the Government of Pakistan has announced vacations due to the COVID-19 pandemic. Hence, the school system and learning methods must change to keep abreast of the changing world. Mahmood (2020) revealed that instructors should come up with diverse teaching strategies and think more creatively to have more control over students' performance such as ask them challenging questions to get their feedback and, therefore, to make them more focused, active, and engaged in online classes. In order to increase the students' interest, motivation and performance in online learning, Sutarto, Sari & Fathurochman, (2020) asserted that the material should be brief, clear, interesting, and easy to understand to remain active and enthusiastic in learning.

Preparedness and readiness can be perceived as two crucial factors to be taken into account in the development of online classes (Ilgaz, & Gulbahar, 2015) in a time of crisis. Warner, Christie, & Choy considered readiness of students for e-learning in three aspects. Warner, Christie, & Choy as cited in Hukle (2009), defined readiness as the inclination of students' towards e-learning against face-to-face teaching strategy, learning experiences based on ICT tools and techniques and their engagement in independent learning. Arif's work (2001), has led to the idea of preparedness that are the student well prepared and competent enough in using the digital technology within the context of institutions' e-learning environments. Research on the preparedness and readiness of students and teachers for online classes can help schools and stakeholders better understand the situation of their students, teaching staff and schools. Reduction of the negative impact of COVID-19 on learning and schooling is extremely important. According to Prensky (2001), students as digital natives today are all 'native speakers' of the digital language of computers and the Internet, which has led to the idea that those who have grown up with computers and Internet access are innately comfortable with technology and educational institutions have committed considerable efforts to design and execute

an online learning approach. We must also, think of how the Pakistani education system can recover with a renewed sense of responsibility for all teachers, parents, students, and all other “digital natives”. Hence, there is a need to minimize the gap in opportunities and to ensure that all children have the same chances for quality of education in Pakistan. Pichai (2019) also stated that education would not be enhanced through technology alone, but technology can have influential and dynamic roles in the solution.

2. Statement of the problem

A plethora of computer technologies has made distance learning easy and effective. There are several open-source learning tools and interactive applications: Zoom™ meeting, Edmodo™, Google classrooms™, Skype™, Whats App™, Meet™, Moodle™ Live television broadcasts such as Virtual University of Pakistan and Lahore College for Women University have also made a contribution to distance learning. These learning platforms and tools are highly productive for students, educators, teachers, and professionals because most students have access to digital devices. Learning Management System and Internet is the most significant and influential players. Many educational institutions are opting for online classes using relevant and well-known public platforms for students in lockdown. The Pakistani Government has also launched ICT-enabled learning platforms (e.g. Virtual University, Lahore College for Women University). Most of these tools are augmented with synchronous face-to-face video instruction to help preempt school closures. In this regard, parents are helping their children to navigate and set up online sessions at home. As such, the preparedness and readiness of teachers and students together with technology are the most important aspects of this specific situation. It is too early to judge how COVID-19 will affect the Pakistani education system and cause a lot of inconvenience or convenience for students, teachers and parents. In view of online learning, the readiness of students, trainers, and institutions is crucial for better execution of online learning (Bowles, 2004). Aydin & Tasci (2005) claimed that student readiness is a very important factor. Inability to recognize teachers' preparedness towards online teaching can pose an important barrier to student engagement which may result in unsatisfied students, attrition, loss of revenue and not meeting study objectives (as cited in Hoppe, 2015, p. 4). On a more comprehensive view, Martin, Budhrani & Wang (2019) described the attitude of their instructors' towards online teaching and notions of their ability - readiness as a state of preparedness for online teaching. Students and teachers may be reasonably prepared and ready to deal with technology are considered for the

design and delivery processes of online learning. In this way, online classes will make them responsible for pursuing and setting their own goals.

The main objective of this study was to ascertain the degree of readiness and preparedness of students and teachers for the implementation of online classes besides the experiences of students, teachers and parents regarding the online sessions during lockdown. This study encouraged teachers to learn about different technological skills (Ventayen, 2019) such as Google Earth Map Tool, Zoom, Meet, other pedagogical strategies and tools that are needed for online education. The results will be of great interest to the readers of the journal, especially those involved in research of the effect of this unique pandemic upon the educational sector in their home country with respect to technology, teaching methods and social roles.

2.1 Study objectives

The study aimed to:

1. Explore the degree of readiness and preparedness of students and teachers for implementation of online classes by private primary and secondary schools of Punjab province due to the COVID-19 pandemic.
2. Explore the experiences regarding online sessions for students, teachers, and parents by private primary and secondary schools of the Punjab province due to the COVID-19 pandemic.

2.2 Research questions

The main research questions were:

1. What is the extent of preparedness and readiness of students and teachers of private primary and secondary schools to participate in online sessions in a time of crisis?
2. What are the experiences of students, teachers, and parents regarding online learning classes during pandemic?

3. Literature review

Himmelsbach (2019) stated that technological innovation is a life skill and a fundamental ability. We live in a computerized world, and from e-books and applications to institutional platforms, there is no shortage of tools that can change the classroom. These innovations in the learning environment could have a lasting impact on the digital world. With a changing world, the mode of teaching and learning is also changing along with new challenges that students and educators faced. Furthermore, technological, and academic developments have helped to define another worldview of online teaching and learning. European Commission (2019) indicated digital technologies affect innovation and their success is associated with

how institutions use online platforms and ready-to-use digital tools to reach customers. Teachers and students are the vital elements that are needed to switch to online classes where students can be engaged with wikis, blogs, email (Daniel, 2020), Zoom™ meeting, Edmodo™, Google classrooms™, Skype™, WhatsApp™, Meet™, Moodle™, You Tube educational channels along with smart pedagogical tools such as Google Earth Map Tool to suit their schedules. Teachers, institutions, and parents have worked hard to keep the process of teaching and learning alive during pandemics as also, Ouma, Awuor & Kyambo (2013) found in their study that readiness for e-learning is a prerequisite for the effective implementation of online classes, which is a platform to integrate technology. Learning with technology is also imperative particularly in COVID-19 and therefore, both teachers and students should be equipped with technical skills to manage the settings of online classes.

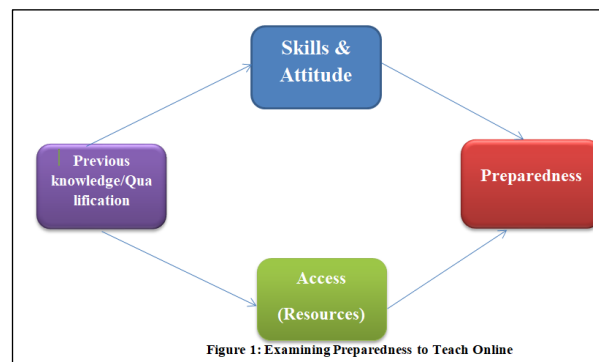
Effective online learning by students requires a dynamic teaching method in which opportunities for student involvement can be facilitated and encouraged. There are several other factors that can influence the readiness of online classes in order to expedite the learning procedure during pandemic. Peytcheva-Forsyth, Yovkova & Aleksieva (2018) revealed that perception of course, student's attitude, motivation, computer skills and today's students' demographics contribute to the success or failure of online learning. One of these is the preparedness and readiness of students and teachers towards online sessions for a range of e-learning competencies. However, students need to fully realize the seriousness of the situation and the fact that teachers have had to shift their entire curriculum to e-learning in a short time, which can be nerve-racking for anyone. The traits of students'-readiness such as self-directedness and self-awareness, are likely to be described instead of what students ought to do. Such behaviors are quantifiable and observable; they can be developed, taught and improved. Dray and colleagues (2011) stated that students' traits and technological capabilities are necessary for the overall success of online courses and programs. Student's characteristics involve range of skills such as individual's belief, effectiveness, and time management. More specific characteristics are: the ability to use email and the Internet; access to technology; to use technology successfully online learning. The preparedness of students for a scope of online learning competencies is depicted in behavior-specific terms (Parkes & Reading, 2015). Promoting readiness and preparedness in students and teachers is indispensable for a successful and active teaching-learning environment because both need to be prepared for the changing demands related to online teaching and learning with respect to technology, teaching methods and social roles. Furthermore, self-directed learning affects the readiness, and understanding students'

characteristics, which are crucial to prepare them for online classes.

Hoppe (2015, p. 5) analyzed the key considerations in assessing teacher' readiness is: are extensive teaching experience, teachers' ability to teach confidently, experience of using technology with ease, and communication skills, time management skills, experience of online learning. However, participants will need experience and a positive attitude towards online technologies to interact and collaborate. Hence, the readiness can be interpreted in terms of these factors and can make online collaboration with students effective. The online learning should be free of effort with little or no assistance for learning materials to load in less time, which may improve the quality of the system. Hoppe (2015, p. 6) has also added that the professional development of teachers to create and facilitate online learning successfully, students' training with continuous evaluation and feedback will contribute considerably to preparedness. The best suited measures are learning traits, mental energy for learning, access to the content of courses, access to skills, and access to a computer (Parkes & Reading, 2015). Students should have the ability to utilize online sessions, LMS or learning platforms, Internet and other innovative technologies and they should be ready to take up the responsibility of self-direction and self-awareness of preparing themselves for the purpose. The traits of students must be assessed carefully to improve the quality of online teaching and learning. Teachers could likewise give direction to students and guide in online sessions, which has a bigger effect on learners' readiness. Tang & Lim (2013) asserted that the choices available for online learning, confidence or competence in using the technological platforms, and the ability to learn independently describes readiness for online learning. This is because their knowledge, ability, and confidence to learn online depends on students' attitude on the importance of online learning competencies. Readiness has an important role in encouraging learners to become involved in online learning. Students who have sufficient motivation and responsibility will be involved and engaged with online learning activities. According to Cigdem & Ozturk (2016) readiness can be perceived as a pivotal factor to be considered in the development of online active learning environments as shown in (Figure 2). Responsible students use opportunities to determine the aspects of managing their own learning. They know how to initiate learning, access resources and to manage time productively.

Choucri and colleagues (2003) defined e-readiness as "The ability to pursue value creation opportunities facilitated by the use of the internet". Teachers need to demonstrate and set strategies for effective communication and coordination using educational platforms for their students. Students need to know what, when and how to communicate appropriately. Students' awareness can be improved by self-

management, self-direction when searching online resources for information.



Hoppe (2015, p.4) makes a cautionary observation about the institutions that have not recognized the ideas, experiences, and abilities of their teachers while also are missing a key component in the journey to facilitate online courses and programs. The responsibilities, attitudes and competencies of teachers are required for successful implementation of online classes, and teachers' readiness is based on their preparedness for online teaching. This strategy will help institutions of Pakistan maintain quality education by covering the syllabus and help maintain the flow of study for learners to engage in studies and to complete exams on time. Students and teachers are nonplussed with the current crises; they must look for solutions to these obstacles. Khalid (2020) believed that even if higher educational institutions started remote education practice at the present time, they could improve with time and use it in future emergency situations.

The Pakistan government has put additional efforts to put forth online classes in private schools. According to Pakistan Digital Report (2020), there are 76.38 million users and the number has increased by 35% on Internet access till 2020 in Pakistan. Fortunately, the report on e-learning in schools allows us to keep up to date with new trends and innovations. Due to e-learning's impact on education, Pakistan's government is determined to integrate the technology in private schools countywide and consequently, Pakistan undertook e-learning in private schools.

By shifting the focus to behaviors and a range of online technological competencies, Leaf, Townley-Cochran, Taubman, Cihon, Oppenheim-Leaf., Kassardjian, Leaf, McEachin, & Pentz (2015) revealed that these can also be taught, developed, or improved. Hence, in order to address such distinctions, this paper attempts to explore the degree of readiness and preparedness of students and teachers posed by the transition to online academics by private primary and secondary schools of Punjab Province in Pakistan in the wake of the current pandemic. The paper also explored the experiences of students, teachers, and parents regarding online sessions due to the (COVID-19) pandemic, which is an important and necessary step.

4. Methods

This study used an interpretive quantitative paradigm and was descriptive in nature. Therefore, survey method was used to collect data from students of private schools, their teachers and parents. The study was focused on perceptions of participants about students' level of preparedness and readiness during their transition to e-Learning at the onset of pandemic and their experiences during online session as well. A Google form questionnaire was used to collect data.

4.1 Sample

An online survey was used to collect data. In total, 262 people completed the online survey and therefore, respondents from Punjab were included in the sample of the study to collect primary data through an electronic survey. The people who completed the questionnaire were students, teachers, and parents of primary and secondary schools in Punjab Province involved in online sessions during the COVID-19 lock down. Six cities in Punjab Province (Lahore, Islamabad, Gujranwala, Sialkot, Faisalabad, Kasur) were included in the sample to collect data. A total of 112 (46.6%) of the 240 in the study group were students, 76 (31.6%) of the 240 were teachers and 74 (30.83%) of the 240 were parents respectively. Table 1 summarizes the demographic characteristics of respondents.

4.2 Instrumentation

The online questionnaire was conducted among the target population using Google™ Form, a freely available online platform powered by Google. The researcher developed instrument in English language in the light of literature review for collecting information about the people eliciting their opinions and ideas enabling to benefit it to online teaching-learning environment of Pakistan.

Draft of the questionnaire was finalized on the basis of pilot testing and expert opinion; and the suggestions by them were incorporated that included rephrasing some definitions of terms and sequencing of items. Three separate instruments, for teachers, students, and parents, were developed to collect primary data from the schools of Punjab Province to ascertain the readiness and preparedness of students and teachers for implementation of online classes. The prime consideration was to look for valued information from the questionnaires serving the purpose i.e., the effectiveness of online sessions for students, teachers and mainly from parents.

The response rate was 76%. The readiness of students and teachers for online classes and teaching was assessed by the researcher developed questionnaire having 64 items (students 24 items, teachers, and parents 20 item each).

The questionnaires contained 24 items for students, 20 items for teachers and parents each. There were one open-ended (optional) and remaining close-ended questions that covered mainly the following features: (a) subject matter or concept clarity; (b) learning and teaching; (c) competency; (d) guidance and cooperation; (e) educational platforms; (f) general satisfaction; (g) response rate; (h) feedback; (i) experience (j) readiness of a child and (k) suggestions for improvement.

The online survey enquired about the aspects on a two-point (Yes/No) nominal scale and five-point likert scale for closed ended questions. Fourteen questions were employed to assess the technological competencies of the respondent, whereby each question had three ordinal categories: 1- "Poor", 2- "Good" and 3- "Excellent". A combined "comp_score" was computed by adding up individual skill scores for all 14 questions. The combined score ranged from 14 to 42 (14 being denoting the lowest competency score and 42 reflecting the highest competency). A new categorical variable "comb_cat" was created on the basis of combined competency scores with the categories Poor, Good and Excellent falling between the ranges, respectively, 14-25, 26-33 and 34-42. The skills were combined for using educational platform; MS office; email; browsing; uploading and downloading of files; social networking; self-directed; self-management; time management; firm class discipline; technological competencies; communication skills; professional and personal competencies.

Five factors were extracted using the SPSS; all had high reliabilities with Cronbach's $\alpha > .80$. A panel of two or three experts related to the field of education ensured the validity to determine the language clarity and content validity. The educationists confirmed to have acceptable content validity because the questions were developed based on a review of the literature.

4.3 Data analyses

Data analysis has been carried out using SPSS ver. 25.0 (IBM, Armonk, NY, USA) in the following two sections:

- Descriptive Analysis
- Inferential Analysis

A descriptive analysis was done to give data summaries and also to highlight the important patterns and relationships between various variables. Inferential analysis was performed to test the statistical significance of potential associations between various factors and responses of students and teachers to ascertain the degree of readiness and preparedness for implementation of online classes.

Descriptive Analysis:

A descriptive analysis constituted frequencies and percentages as given in Table 1.

Apart from demographic information in Table 1, nine questions were addressed to the students and teachers about preparedness, and the results are shown in Table 2. The key factors of preparedness and readiness of teachers and students depicted in the Table 2 below are in the form of frequencies and percentages to participate in online sessions in a time of crisis.

It can be seen that 94.6% of students and 89.5% of teachers had access to digital devices which emphasized the availability of ICT tools that could be used in online sessions. Also, 59.2% of teachers were technologically and professionally trained as their knowledge of ICT in education is necessary for online classes.

Most respondents believed that use of ICT in education reduced subsequent teaching time. In terms of examining the teachers' preparedness in online classes during lockdown, 35.5% of teachers were masters, 43.4% were postgraduate and 13.2% were doctorate. This indicates the extent to which their training prepares them to meet unexpected challenges and changing demands which they face in their online classrooms. Schools also provide students and teachers with strong administrative support, supervision, digital devices, platform, and professional training to successfully implement online classes. Students (87.5%) and teachers (94.7%) are provided with some or all resources to adopt remote learning fully that prepares them to be competent in online classrooms.

Characteristic	Respondents	
	Frequency	%
<i>Gender</i>		
Male	22	19.6
Female	240	80.4
<i>Age</i>		
< 11	39	14.9
11 – 20	73	27.9
21 – 49	108	41.2
> = 50	42	16.0
<i>Cities</i>		
Lahore	114	43.5
Islamabad	52	19.8
Gujranwala	25	9.5
Sialkot	38	14.5
Faisalabad	30	11.5
Kasur	3	1.2
<i>Educational level (Student)</i>		
Primary	39	34.8
Secondary	73	65.2
<i>Educational level (Teacher)</i>		
Graduate	6	7.9
Masters	27	35.5
MPhil	33	43.4
Doctorate	10	13.2

Table 1 - Demographic characteristics of respondents.

SR. NO.	Preparedness factors	Categories	Number of respondents (186)	
			Student (112)	Teacher (76)
1	Technological competency	Poor	6(5.4%)	04(5.3%)
		Good	91(81.3%)	24(31.6%)
		Excellent	15(13.4%)	48(63.2%)
2	Student Education Level	Primary	39(34.8%)	--
		Secondary	73(65.2%)	
3	Teacher qualification	Graduate	--	6(7.9%)
		Masters	--	27(35.5%)
		Phil	--	33(43.4%)
		Doctorate	--	10(13.2%)
4	Access to digital devices	No	06(5.4%)	08(10.5%)
		Yes	106(94.6%)	68(89.5%)
5	Follow-up Comments improves understanding	No	12(10.7%)	--
		Yes	100(89.3%)	--
6	Provision of instructional resources	No	14(12.5%)	04(5.3%)
		Yes	98(87.5%)	72(94.7%)
7	Troubleshooting	No	77(68.8%)	17(22.4%)
		Yes	35(31.3%)	59(77.6%)
8	Create quiz/ Assignments	No	29(25.9%)	13(17%)
		Yes	83(74.1%)	63(83%)
9	Trained teachers	No	60(53.6%)	31(40.8%)
		Yes	52(46.4%)	45(59.2%)

Table 2 - Classification of Respondents with respect to Preparedness Levels.

Inferential analyses

Inferential analysis involved application of tests of association using the Pearson chi-square (Daniel & Cross, 2018) test between various factors of preparedness and responses of students and teachers to ascertain the degree of readiness and preparedness for implementation of online classes.

Bivariate analyses of variables are shown in Table 3.

The availability of a smooth and fast Internet facility was found to be significantly associated with class discipline ($\chi^2 = 4.148$, $p = 0.042$). Hence, if there was no internet disruption during online sessions, then it was easier to maintain class discipline. An absence of a smooth and fast internet was a hindrance to joining online classes. The ability of students, teachers, and parents to trouble-shoot technological issues during online sessions played an important part in time management in class and was found to be significantly associated with each other ($\chi^2 = 4.052$, $p = 0.044$). There was a significant association between the

technological competency of teachers and the appropriate content delivery by them during online sessions which indicated that self-efficacy of the teachers to access and use technologies led to fewer flaws in content delivery ($\chi^2 = 6.554, p=0.038$) as they were able to develop and use online course material in a better manner using various video conferencing applications and computer mediated tools. There was no significant association found in online learning of subject knowledge the same way as in physical classroom and the trained teachers for online sessions ($\chi^2 = 2.266, p=0.132$). Hence, regardless of teachers being trained to deliver subject knowledge successfully during online sessions, it was not the same as content delivery in a school classroom environment. In online sessions administered by schools, a significant association was found between disruptions on the Internet and non-seriousness of students ($\chi^2 = 5.084, p=0.024$). Smooth and fast internet access make students more engaged, attentive, responsive and participative in online classrooms, whereas non-availability or slow internet results in non-seriousness on the part of students. The test of association suggested that firm class discipline could not be maintained because of the non-seriousness of the students during online sessions as indicated by the significant association found between lack of class discipline and non-seriousness of students ($\chi^2 = 6.703, p=0.010$).

Variable 1	Variable 2	χ^2 - value	p- value
Smooth Internet	Firm class discipline	4.148	0.042
Troubleshooting	Time management	4.052	0.044
Technological competency	Efficient content delivery	6.554	0.038
Trained teachers	Online learning same as in physical classroom	2.266	0.132
Smooth Internet	Students' non-seriousness	5.084	0.024
Non-seriousness of students	Firm class discipline	6.703	0.010

Table 3 - Bivariate Analysis.

One open-ended question was asked from all respondents with regard to their experiences of online classes in an emergency situation.

Students: The attitude of some students during online classes needs to be improved. Seriousness on the part of students should be inevitable and they should avoid disrupting these classes for their amusement which learners need to understand. Some students find it difficult to understand the concepts given by teachers

online. Online learning creates many health and social problems. Some students cannot stay constantly in front of a laptop, computer, or phone. Interaction with another person online can be hampered due to connectivity issues. Online sessions are not beneficial for students because institutions do not have the appropriate infrastructure. Some stated that they found no significant flaw in the online teaching system and did not find difficulty in switching from a physical classroom to an online classroom. However, students living in remote areas did not have an Internet facility and found difficult to switch between the medium. Instead of online classes, lectures should be uploaded so that the students without an Internet facility will not miss the lecture. Online classes should not be considered a permanent medium because several aspects cannot be taken care of in an online teaching system, such as personality development, social skills, and co-curricular activities. There should be online interactive programs during the school year so that, if an emergency arises, one knows how to deal with it. Some respondents found online education convenient, enjoyed the service, and felt that the time that could have been "wasted" due to the COVID-19 was saved and the syllabus could be covered in a timely manner. It would be better to create one portal where lectures can be posted for a specific time. Too many assignments with short deadlines should be avoided and teachers should not post assignments during weekends. Graded assignments are not posted by most teachers so students who have worked hard do not know how they performed.

Teachers: According to teachers, students have not taking online classes seriously. The Parents should enforce and assist them to complete homework on time and students should practice themselves too. Reading books should be made compulsory during their free time. Training regarding online teaching for faculty and students must be provided. Online classes may help if teachers are fully equipped and trained according to the requirements for online teaching. Also, how well adapted and well-equipped students are, and the extent to which they are serious about their course and studies is important. Ensuring that, students are busy and productive will help to avoid stress and frustration during the COVID-19 pandemic. Not every student and teacher will have an Internet facility at home. Hence, an educational "Web TV" channel should be introduced where lectures of all classes are conducted, may be a more suitable way forward in the future. Children in junior classes will need parent's assistance, but some parents are unaware of how to use computer appropriately. Moreover, some teachers recommended that it is necessary to keep students engaged so that they do not feel isolated, and students should be provided the opportunity to participate in online group discussions. Lastly, new academic their free time. Training regarding online teaching for faculty and students must

be provided. Online classes may help if teachers are fully equipped and trained according to the requirements for online teaching. Also, how well adapted and well-equipped students are, and the extent to which they are serious about their course and studies is important. Ensuring that, students are busy and productive will help to avoid stress and frustration during the COVID-19 pandemic. Not every student and teacher will have an Internet facility at home. Hence, an educational “Web TV” channel should be introduced where lectures of all classes are conducted, may be a more suitable way forward in the future. Children in junior classes will need parent’s assistance, but some parents are unaware of how to use computer appropriately. Moreover, some teachers recommended that it is necessary to keep students engaged so that they do not feel isolated, and students should be provided the opportunity to participate in online group discussions. Lastly, new academic calendars should be scheduled.

Sr. No.	Key factors	Categories	Number of respondents (262)		
			Student (112)	Teacher (76)	Parents (74)
1	Technological competency	Poor	6(5.4%)	04(5.3%)	07(9.5%)
		Good	91(81.3%)	24(31.6%)	20(27.0%)
		Excellent	15(13.4%)	48(63.2%)	47(63.5%)
2	Troubleshooting	No	77(68.8%)	20(26.3%)	40(54.1%)
		Yes	35(31.3%)	56(73.7%)	34(45.9%)
3	Smooth Internet	No	64(57.1%)	24(31.6%)	39(52.7%)
		Yes	48(42.9%)	52(68.4%)	35(47.3%)
4	Easy Interaction	No	76(67.9%)	--	--
		Yes	36(32.1%)	--	--
5	Students' Non-seriousness	No	36(32.1%)	54(71.1%)	25(33.8%)
		Yes	76(67.9%)	22(28.9%)	49(66.2%)
6	Complete assignments independently	No	60(53.6%)	--	45(60.8%)
		Yes	52(46.4%)	--	29(39.2%)
7	Good time management	No	62(55.4%)	36 (47.4%)	53(71.6%)
		Yes	50(44.6%)	40(52.6%)	21(28.4%)
8	Students enjoy online sessions	No	50(44.6%)	--	--
		Yes	62(55.4%)	--	--
9	Trained teachers	No	--	43(56.6%)	17(23%)
		Yes	--	33(43.4%)	57(77.0%)
10	Switch to Online	No	83(74%)	40(52.6%)	--
		Yes	29(26%)	36(47.4%)	--
11	Morals	No	--	42(55.3%)	54(73%)
		Yes	--	34(44.7%)	20(27%)
12	Online Continuation	Temporarily	--	44(57.9%)	60(81.1%)
		Permanently	--	22(28.9%)	2(2.7%)
		No	--	10(13.2%)	12(16.2%)

Table 4 - Key factors of the respondents’ experiences for online sessions in a time of crisis.

Parents: Online education is fulfilling academic requirements to a reasonable extent, but children are finding difficulties in understanding the concepts and are not learning basic manners and etiquettes. Teachers should be proficient in online education strategies. The online sessions should be more interactive and should

focus on individual attention. Some parents suggested that online teaching should involve innovative ways of learning through games and quizzes. Online classes should be continued temporarily so that students may involve themselves in healthy activities. Requisite online training for teachers must be provided, and teachers must be confident in using digital technology to manage time, discipline and to enhance student interest in class.

Results and Discussion

The experiences of students, teachers, and parents regarding online sessions, in a time of crises, have been reported in counts (percentages) as shown in Table 4.

Most of the students seemed to have good (81.3%) technological competency regarding online learning experience while majority of the teachers had excellent (63.2%) and good (31.6%) competency in managing technical aspects of the online sessions. A great number of parents (63.5%) were also technologically sound enough to assist their children in attending online sessions. 68.8% of the students had poor ability to troubleshoot technological issues online. Furthermore, 73.7% of the teachers and 54.1% of the parents’ exhibited confidence in troubleshooting. Yacoba, Kadirb, Zainudinc, & Zurairahd (2012) examined the plan of action for successful online classes for students that is to be aware of new technology and willingness to study. Teachers (68.4%) acknowledged the smooth and fast Internet access during the online sessions which indicated the preparedness and readiness of them. Although 57.1% of students and 52.7% of the parents complained about weakness of the Internet signal at home which may have been the reason for the non-seriousness of students as it was also hard to ask queries during online sessions. Large number of students (67.9%) complained about asking queries from teacher easily during online sessions. Maheshkar and Soni (2016) concluded in his study of examining online education that serious impediment in joining online classes is the students’ access to online platforms and Internet connectivity which is not viable to every student. All these issues affected time management and firm discipline in class.

Non-seriousness on the part of students was observed by students (67.9%), teachers (28.9%) and parents (66.2%) during online conduct of the classes. It was realized that slowness or non-availability of the Internet might have contributed to the non-serious behavior of the students which led to poor time management and also the firm class discipline could not be maintained. Almost half number of students (53.6%) found it difficult to complete their assignments independently without any assistance whereas parents (39.2%) experienced assisting their children in completing their school assignments. Without parental assistance they

were not able to complete their tasks independently, however, the students at this level were required to realize the need of their role of self-directedness, self-management and solve tasks independently. Quite a large number of students (55.4%) and parents (71.6%) observed poor time management in online classes, while almost half of the teachers (52.6%) were of the different view. Also majority of students seemed to be motivated as 55.4% of them enjoyed online sessions which was an indication of readiness of students. Yacob, Kadir, Zainudin, & Zurairah (2012) found that the students of primary and secondary levels are still teenagers and required interactive learning that will make them ready for learning.

Training for teachers to be prepared in using computer mediated applications and digital technology was the requisite for e-learning for effective content delivery, firm class discipline and to keep students active and responsive in class. 56.6% of the teachers found that training must have been provided to improve their preparedness for online teaching and parents (77%) pointed out that teacher training was essential for good class management and interactive teaching. Maheshkar and Soni (2016) indicated that the learner learns more when they are active participant and engaged in associated activities. Switching from traditional schooling to online platforms was found to be difficult by teachers (47.4%), whereas most of the students (74%) experienced the switch not that difficult. Benchevae (2010) concluded in his study that online learning also includes various components that are very familiar with the face-to-face learning, such as,

students' creative ideas, group discussions, assignments, gave remarks on assignments, and other different forms. Teachers (55.3%) and parents (73.0%) reported that students had not learned etiquettes and morals in online environment. Teachers (57.9%) and parents (81.1) were of the view that online classes should continue only temporarily until the crises of COVID-19 prevails. Furthermore, 28.9% of teachers wanted to switch to online more on the permanent basis, whereas almost all the parents (97.3%) opposed it. Teachers (13.2%) and parents (16.2%) were not in the favor of online classes.

On the basis of findings, the researcher developed a model for teachers and students' preparedness before online learning. The model highlights students' and teachers' traits to successfully benefit from online sessions and overcome their challenges. The model was chosen to incorporate behavior-specific terms and a range of technological competencies. It explores the factors that have an impact on students' and teachers' readiness to adopt online classes in schools of developing countries like Pakistan. Thus, for the successful implementation of online sessions during pandemic the model was proposed for the readiness to embrace technology and attitude of students towards e-learning.

The model is based on the findings of the study to reduce barriers in successful implementation of online classes and for improvement on the current situation.

- It is obvious that students need to possess a positive attitude towards innovations to confidently participate in online sessions, which

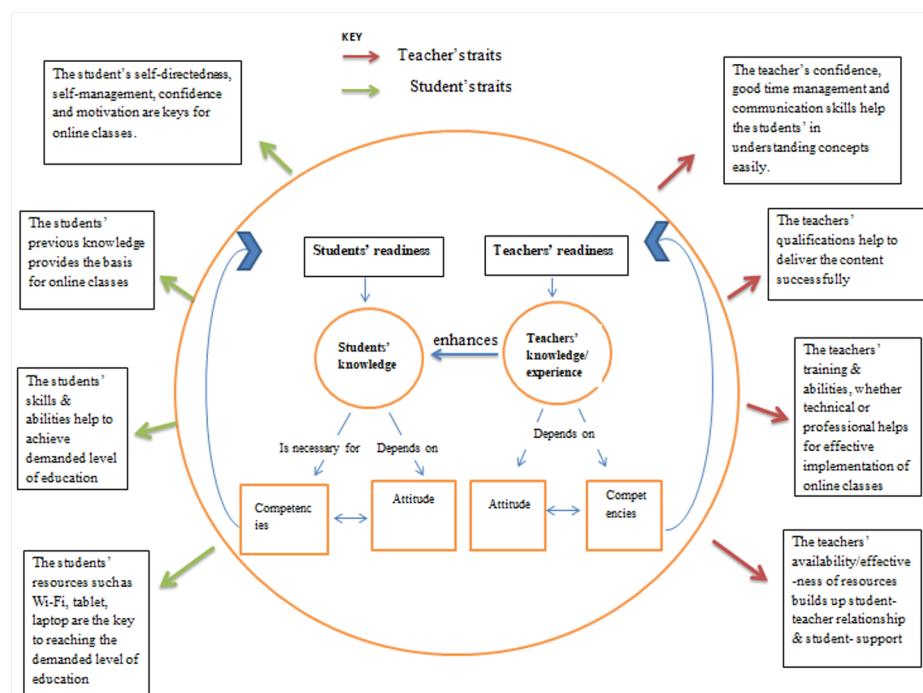


Figure 2 - The researcher made model for readiness of students and teachers for implementation of online classes.

implies that they are more likely to accept and adapt it well, as a mode of education in maintaining their interest.

- Successful implementation of online classroom activity in education requires commitment. Moreover, effective and successful implementation largely depends on teachers who require in-depth professional development to improve students' learning, but how they will improve the skills and competencies acquired from the tools and training provided to them is another part of the issue that needs to be addressed.
- Keen attention needs to be given to teachers' training to adopt innovations (as cited in Nikolopoulou, 2018, p. 93) and to acquaint them with the sufficient technological competencies, so to keep teachers well-informed with ever-changing technologies and to prepare them to confidently use technology effectively in their teaching.
- Different teaching methods with the variety of creative processes in which learners can engage (as cited in Nikolopoulou, 2018, p. 89) should also be developed through the use of new educational and communications technology.
- Effective implementation of online classes involves substantial resources, which is very hard to manage in developing countries like Pakistan. Inequity of access to high speed Internet and related modern digital devices to every student negatively influences the use of ICT in education.

Conclusion and Suggestions

According to the findings, students and teachers are moderately ready for online classes in the time of crisis. The results showed that the students' and teachers' readiness is their technological competencies, time management skills, effective content delivery, and attitudes. The results indicate that the students seemed to have good (81.3%) and teachers had excellent (63.2%) technological competencies in managing technical aspects of the online sessions which indicated their technical readiness for the online mode to see whether they were prepared to switch schooling to a new system. However, students (57.1%) and parents (52.7%) complained about the smooth Internet connection, whereas, teachers (68.4%) acknowledged the smooth and fast availability of the Internet which indicated that if there was no internet disruption, then it was easier to maintain class discipline, whereas, non-availability or slow internet resulted in non-seriousness on the part of students. Smooth and fast internet access made students more active and interactive in online classrooms. The test of association also suggested that firm class discipline could not be maintained because

of the non-seriousness of the students during online sessions as indicated by the significant association found between lack of class discipline and non-seriousness of students ($\chi^2 = 6.703, p=0.010$). The study revealed that there is little awareness among students on how they should behave in the online environment and therefore, understanding student characteristics is important to prepare students for online learning.

Moreover, 71.6% of parents and 55.4% of students indicated poor time management in online classes as also 77% of parents pointed out that there is a need for more teacher-training workshops for good class and time management. The teachers' ability to teach confidently is based on the use of technology in education that reduced subsequent teaching time and improves the preparedness for online classes. Furthermore, 56.6% of the teachers also agreed on the need for training. Agormedah, Henaku, & Ayite, (2020) found similar issues associated with teachers' training and students' behavior; lack of teachers' training, experience in online learning platforms and students' unpreparedness in active participation in learning, technical skills proficiency, self-directed learning, and efficacy in the use of e-learning devices has affected remote education. Using the survey information, the researcher has developed a model for students and teachers' key traits as a pre-requisite for online sessions. This model is recommended to be adopted by all online disseminating institutes and agencies for its smooth running and maximum effectiveness.

Furthermore, it is recommended that the Pakistan government should take more strategic steps for the successful implementation of online learning in primary and secondary schools of Punjab to make accommodations for students who do not have digital devices and Internet accessibility. Also, the study suggests that changes in the schools of Punjab Province are not straightforward and easily accessible and instead they require the collaborative efforts of educational administrators, technological experts, decision-makers, educational institutions, and teachers, all of whom are stakeholders in the education sector. It is also important to expand the scope of online sessions providing requisite training to students, teachers, and schools for effective use of the Internet and to resolve troubleshooting issues. Therefore, appropriate guidance and training will lead to the effective use of learning resources.

Acknowledgments

Thanks to Mr. Makhdum Tariq Salim for his useful comments which became a motivation for me to complete this manuscript and always supported spiritually throughout my research.

References

- Agormedah, E.K., Henaku, E.A., & Ayite, D., (2020). Online Learning in Higher Education during COVID-19 Pandemic: A case of Ghana. *Journal of Educational Technology and Online Learning*, 3, 183-210. DOI. 10.31681/jetol.726441.
- Arif, A. (2001). Learning from the web: Are students ready or not. *Educational Technology & Society*, 4(4), 32-38.
- Aydin, C. H., & Tasci, D. (2005). Measuring Readiness for e-Learning: Reflections from an Emerging Country. *Journal of Educational Technology & Society*, 8 (4), 244-257.
- N. Bencheva (2010): Learning styles and e-learning face-to-face to the traditional learning, *Proceedings of the University of Ruse*, 49, 63–67.
- Bowles, M. (2004). *Relearning to e-learn: strategies for electronic learning and knowledge*. Carlton, Victoria, Australia, Melbourne University Press.
- Choucri, N., Maugis, V., Madnick, S., Siegel, M., Gillet, S., O'Donnell, S., et al. (2003). *E-readiness for what?* Cambridge: MIT Journal of Center for eBusiness at MIT id 1/4 535762
- Cigdem, H., & Ozturk, M. (2016). Critical Components of Online Learning readiness and their relationships with learner achievement. *Turkish Online Journal of Distance Education*, 8(2), 17. <https://files.eric.ed.gov/fulltext/EJ1097239.pdf>
- Daniel, S.J. (2020). Education and the COVID-19 pandemic. *UNESCO IBE. Prospects* 49, 91–96 (2020). <https://doi.org/10.1007/s11125-020-09464-3>
- Daniel, W.W. & Cross, C.L. (2018). *Biostatistics: A Foundation For Analysis In The Health Sciences*, Eleventh Edition John Wiley & Sons, Inc. [https://doi.org/10.1002/1097-0258\(20010130\)20:2<324::AID-SIM635>3.0.CO;2-O](https://doi.org/10.1002/1097-0258(20010130)20:2<324::AID-SIM635>3.0.CO;2-O)
- Digital 2020: Pakistan, (2020). *DATAREPORTAL*. <https://datareportal.com/reports/digital-2020-pakistan>
- Dray, B. J., Lowenthal, P. R., Miskiewicz, M. J., Ruiz-Primo, M. A., & Marczyński, K. (2011). Developing an instrument to assess student readiness for online learning: a validation study. *Distance Education*, 32(1), 29-47. DOI. 10.1080/01587919.2011.565496.
- European Commission (2019). *Shaping Europe digital future [Brochure]*. <https://ec.europa.eu/digital-single-market/en/news/how-do-online-platforms-shape-our-lives-and-businesses-brochure>: Prabhat Agarwal
- Himmelsbach, V. (2019). *Technology in the Classroom in 2019: 6 Pros & Cons* [Blog Post]. <https://tophat.com/blog/6-pros-cons-technology-classroom/>
- Hoppe, D.W. (2015). *Addressing Faculty Readiness for Online Teaching*. the D2L family of companies. www.d2l.com/wp-content/uploads/2015/02/Addressing-Faculty-Readiness_BestPracticesPaper_Final.pdf
- Hukle, D.R.L. (2009). *An Evaluation of Readiness Factors for Online Education*. ProQuest LLC. *Theses and Dissertations*. <https://scholarsjunction.msstate.edu/td/524>
- Ilgaz, H. & Gulbahar, Y. (2015). A Snapshot of Online Learners: e-Readiness, e-Satisfaction and Expectations. *International Review of Research in Open and Distributed Learning*, 16 (2), 171-187.
- Junus, K., Santoso, H.B., Putra, P.O.H., Gandhi, A., Siswantining, T., (2021). *Lecturer Readiness for Online Classes during the Pandemic: A Survey Research*. *Education Sciences*. <https://doi.org/10.3390/educsci11030139>
- Khalid, A. (2020). *Are Pakistan's public universities prepared for online education?* the MIT Technology Review <http://www.technologyreview.pk/are-pakistans-public-universities-prepared-for-online-education/>
- Leaf, J.B., Townley-Cochran, D., Taubman, M., Cihon, J.H., Oppenheim-Leaf, M.L., Kassardjian, A., Leaf, R., McEachin, J., & Pentz, T.G. (2015). *The Teaching Interaction Procedure and Behavioral Skills Training for Individuals Diagnosed with Autism Spectrum Disorder: A Review and Commentary*. *Review Journal of Autism and Developmental Disorders*, 402–413. <https://doi.org/10.1007/s40489-015-0060-y>
- Li, H., Liu, S., Yu, X., Tang, S., & Tanga, C. (2020). *Coronavirus disease 2019 (COVID-19): current status and future perspectives*. *Journal of Elsevier Public Health Emergency Collection*, 55(5). Doi: 10.1016/j.ijantimicag.2020.105951
- Li, C. & Lalani, F. (2020, April 29). *The COVID-19 pandemic has changed education forever. This is how*. World Economic Forum. <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/>
- Maheshkar, C. and Soni, N. (2016). *Spreading education online: Issues, strategies and benefit*. *Pakistan Journal of Distance and Online Learning*, 2(1), 1-14.

- Mahmood, S. (2020). Instructional Strategies for Online Teaching in COVID-19 Pandemic. *Human Behavior and Emerging Technologies*, 3(9), 199-203. DOI: <https://doi.org/10.1002/hbe2.218>.
- Martin, F., Budhrani, K., & Wang, C. (2019). Examining faculty perception of their readiness to teach online. *Online Learning*, 23(3), 97-119. doi:10.24059/olj.v23i3.1555
- Nikolopoulou, K. (2018). Creativity and ICT: Theoretical Approaches and Perspectives in School Education. In T. A. Mikropoulos (ed.), © Springer International Publishing AG, (pp. 87-100), DOI: 10.1007/978-3-319-95059-4_5
- Ouma, G.O., Awuor, F.M. & Kyambo, B. (2013). E-Learning Readiness In Public Secondary Schools In Kenya. *European Journal of Open, Distance and E-Learning*, 16 (2) 97-110.
- Parkes, M., Stein, S., & Reading, C. (2015). Student preparedness for university e- learning environments. *The Internet and Higher Education*, 25, 1-10. DOI: 10.1016/j.iheduc.2014.10.002
- Peytcheva-Forsyth, R., Yovkova, B. & Aleksieva, L. (2018, December 11). Factors affecting students' attitudes towards online learning - The case of Sofia University. *AIP Conference Proceedings*. Vol: 2048, eResearch Sofia Conference, Bulgaria. <https://doi.org/10.1063/1.5082043>
- Pichai, S. (n.d). What is G suite for Education? Teach thought we grow teachers. <https://www.teachthought.com/technology/what-is-google-for-education/>
- Prensky, M. (2001), Digital Natives, Digital Immigrants Part 1, *On the Horizon*, 9 (5), 1-6. <https://doi.org/10.1108/10748120110424816>
- Sutarto, S., Sari, D. P., & Fathurochman, I. (2020). Teacher strategies in online learning to increase students' interest in learning during COVID-19 pandemic. *Journal Konseling dan Pendidikan*, 8(3), 129-137. <https://doi.org/10.29210/147800>
- Tam, G., & El-Azar, D. (2020, March 13). Three ways the coronavirus pandemic could reshape education. *World Economic Forum*. <https://www.weforum.org/agenda/2020/03/3-ways-coronavirus-is-reshaping-education-and-what-changes-might-be-here-to-stay/>
- Tang, S. F. & Lim, C. L. (2013). Undergraduate students' readiness in e-learning: a study at the business school in a Malaysian private university. *International Journal of Management & Information Technology*, 4 (2), 198-204. DOI: <https://doi.org/10.24297/ijmit.v4i2.1900>
- Velloso, Y. (2020, April 6). Malala Fund releases report on girls' education and COVID-19. Malala Fund. https://www.malala.org/newsroom/archive/malala-fund-releases-report-girls-education-covid-19?gclid=CjwKCAjw-YT1BRAFEiwAd2WRtjXsvhCdI52h35CAzflBofO6xlSKCuLSLMGHmo0AEsV-VHU5E63ZRxoCLh8QAvD_BwE
- Ventayen, R. J. M. (2019). Educators competencies on the application of technological tools in teaching. *International Journal of Scientific and Technology Research*, 8(11), 1-7.
- Yacob, A., Kadir, A.Z.A., Zainudin, O. & Zurairah, A. (2012). Student Awareness Towards E-Learning In Education. *Proceedings of the 3rd International Conference on e-Learning, Bandung, eResearch Indonesia Conference*. 67. 93–101. Doi: 10.1016/j.sbspro.2012.11.310

Learning from a distance during a pandemic outbreak: factors affecting students' acceptance of distance learning during school closures due to COVID-19

Bobby Ardiansyahmiraja^{a,b}, Reny Nadlifatin^{1,c}, Satria Fadil Persada^d, Yogi Tri Prasetyo^d,
Michael Nayat Young^d, A. A. N. Perwira Redi^e, Shu-Chiang Lin^f

^a Faculty of Business and Economics, Universitas Surabaya (Indonesia)

^b Department of Technology Management, Institut Teknologi Sepuluh Nopember (Indonesia)

^c Department of Information System, Institut Teknologi Sepuluh Nopember (Indonesia)

^d School of Industrial Engineering and Engineering Management, Mapua University (Philippines)

^e Industrial Engineering Department, BINUS Graduate Program - Master of Industrial Engineering, Bina Nusantara University (Indonesia)

^f Texas Health and Science University, Austin, USA

(submitted: 8/12/2021; accepted: 27/10/2021; published: 10/11/2021)

Abstract

Distance learning has become the only solution for learning in the current Covid-19 pandemic outbreak. A more straightforward form of distance learning with the utilization of telepresence and cloud-based productivity tools was apparent in many institutions. The present study investigated this phenomenon and ask, "What factors affect students' acceptance of distance learning during school closures due to COVID-19?". An extended Unified Theory of Acceptance and Use of Technology was employed to answer the research question, with 156 students participating in the study. The result revealed that Effort Expectancy (EE) has the biggest effect on students' acceptance of distance learning during school closures ($\beta=0.372$, $p<0.001$). Additionally, the extended variable of Social Presence (SP) was also showing great effects on students' acceptance ($\beta=0.296$, $p<0.001$). However, one of the UTAUT constructs, Facilitating Conditions, was found to have no effect on students' acceptance. Practical implications for schools and distance learning program managers were discussed to provide insight on improving a distance learning program. This study contributes to the body of knowledge on learning technologies as well as on how society, especially in the educational sector, should continue despite the current pandemic crisis.

KEYWORDS: Distance Learning, Covid-19, SEM, Social Presence, Zoom.

DOI

<https://doi.org/10.20368/1971-8829/1135412>

CITE AS

Ardiansyahmiraja, B., Nadlifatin, R., Persada, S.F., Prasetvo, Y.T., Young, M.N., Perwira Redi, A.A.N., & Lin, S.-C. (2021). Learning from a distance during a pandemic outbreak: factors affecting students' acceptance of distance learning during school closures due to COVID-19. *Journal of e-Learning and Knowledge Society*, 17(2), 21-31. <https://doi.org/10.20368/1971-8829/1135412>

1. Introduction

There are almost 20 million recorded cases of Covid-19 as of 11 August 2020 (World Health Organization, 2020). The social restrictions and health protocols to mitigate the spread of the virus has affected all walks of life, including education. Although many governments have started to reopen their country in some areas to avoid an economic crisis (Cushman & Wakefield, 2020), school reopening is yet to reach a consensus: on 3 August 2020, more than 1 billion students (or 60.5% of total enrolled learners) are still affected by school

¹ corresponding author - email: reny@its.ac.id – address: Kampus ITS, Keputih, Kec. Sukolilo, Kota SBY, Jawa Timur 60117 (ID)

closures (UNESCO, 2020). Since the start of nationwide lockdowns in many countries in March, for six months, teachers and students globally have been using 'quick fixes' in order to keep the educational process continues (Teräs et al., 2020). These 'quick fixes' encompass a broad set of tools and strategies for delivering education amid a pandemic. However, the main strategy recommended by the World Health Organization (WHO) to slow the spread of Covid-19, and has been used in almost every country, is distance learning (Dietrich et al., 2020; World Health Organization, 2020).

Distance learning is the process of teaching and learning at a distance. Involvement between instructors and learners in a timely manner is also an essential aspect of distance learning (Tsai & Machado, 2002). In achieving successful distance learning, a proper medium for transferring the instruction and feedback is needed. In the era when the Internet is not yet available economically to the masses, traditional distance learning was commonly used as the main medium. In a traditional distance learning, textbook replaces direct instructions, and students can go to a local study center if extra support is needed (Beyth-Marom et al., 2003). However, as the Internet became increasingly accessible, distance learning mediums are now more reliant on Information and Communications Technology (ICT) (Andrews & Tynan, 2012)

In today's distance learning situation, some technologies are commonly utilized. These technologies are very ranging in complexity (Sandars et al., 2020). Some teachers have used a messaging service such as WhatsApp to deliver their learning materials, while others have used technologies as sophisticated as game-based education using Minecraft (Bos et al., 2014; Gon & Rawekar, 2017).

In the current Covid-19 pandemic situation, many institutions utilized a simpler online learning approach, which is videoconferencing: when people in two or more distant locations can communicate in real-time using live audio and video (Anastasiades et al., 2010). Various cloud-based productivity tools such as Google Drive, Gmail, and Google Docs were also used on top of video conferencing (Basilaia et al., 2020; Huang et al., 2020). The trend of using videoconferencing with cloud-based productivity tools as a supporting tool during Covid-19 related school closures is apparent in many institutions around the world; making distance learning during school closures unique and not all findings from past studies investigating distance learning can be directly applied to the current distance learning (Bui et al., 2020; Chawla, 2020; Churiyah et al., 2020; Dietrich et al., 2020; Kondratova, 2020; Tiwari, 2020; Varalakshmi & Arunachalam, 2020).

Although students' attitude towards distance learning and its effectiveness compared to traditional face-to-face learning still varies from research to research, it is

the only viable solution in the current situation (Allen et al., 2004; Hannay & Newvine, 2006; Stonebraker & Hazeltine, 2004). Thus, due to these facts: 1. Distance learning during Covid-19 is unique; 2. It is the only viable solution to education during school closures; and 3. While distance learning has started in most countries in March, students still prefer conventional face-to-face learning; this research is interested in how to increase our understanding of distance learning during school closures due to Covid-19 (Adnan & Anwar, 2020; Amir et al., 2020).

To do this, an aspect of online learning will be the focus of this study. When addressing the interaction between humans and technology, a main theme is usually investigated about: the acceptance of technologies (Hornbæk & Hertzum, 2017; Mun & Hwang, 2003). The acceptance of technology refers to a concept that is crucial to the success of an information system (Stone et al., 2007); it is described as the willingness of a user to utilize a particular technology (Teo, 2014). By understanding what affects users' acceptance of technology, stakeholders will be able to formulate the most appropriate strategy to improve the system. Therefore, the present study asks, "What factors affect students' acceptance of distance learning during school closures due to COVID-19?" A theoretical model known for its ability to answer similar problems was used to answer this question: The Unified Theory of Acceptance and Use of Technology. An additional factor, Social Presence, will also be employed to determine the students' acceptance of distance learning during school closures. The rest of the paper will be organized as follows: Literature Reviews, Methodology, Findings and Discussion, and Conclusion.

2. Literature Reviews

2.1 Distance learning technologies during school closures

During school closures due to Covid-19, a trend in distance learning technologies is apparent. A great example is the popularity surge of Zoom, a multiplatform software that is used for teleconferencing, webinars, and education. Zoom's "annualized meeting minutes" grew from a hundred billion before the pandemic outbreak to over two trillion in April (Turk, 2020). Its use for an educational purpose has mentioned in many research (Chick et al., 2020; Coe et al., 2020; Lewis et al., 2020), and a simple search on Google Trends reveals that before the pandemic (August 2019 – Early March 2020), the keyword "Zoom school" only returned an average of 3.9/100 popularity value, while during the pandemic (March 2020 – Now) it has a 100/100 popularity value (Google, 2020). This means that Zoom and other

teleconferencing platforms, supported by cloud-based collaboration technologies such as Google Drive, Gmail, and Google Docs has dominated the medium of distance learning, creating a similar technology acceptance experiences for students across the globe.

2.2 Theoretical research framework

One of the most used theoretical frameworks in answering technology acceptance is the Unified Theory of Acceptance and Use of Technology (UTAUT). This framework was formulated as an attempt towards unifying some of the most used models on technology acceptance. The models which act as the foundation of UTAUT include the Innovation Diffusion Theory, Theory of Reasoned Action, the Technology Acceptance Model, the Theory of Planned Behavior, the combined TAM/TPB, the Model of PC Utilization, the Motivational Model, and the Social Cognitive Theory. UTAUT synthesized these models and revealed four main variables that significantly influence an individual's intention to accept or adopt a technology: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions (Venkatesh et al., 2003). UTAUT has been used in many different contexts related to technology acceptance, ranging from learning technologies acceptance to autonomous car adoption (Kettles & Van Belle, 2019; Persada et al., 2019). UTAUT claimed and has proven to have the ability to explain 70% of the variance in users' intention to accept a technology (Birch & Irvine, 2009; Marchewka & Kostiwa, 2007; Venkatesh et al., 2003). Thus, considering the prominence of UTAUT in investigating technology acceptance, its broad range of applications including on learning technology, and how UTAUT's variables relate accordingly to the context of distance learning during Covid-19, the present study will use this framework to answer its research question.

The UTAUT factors and their association with the behavioral intention to use technology, along with the hypotheses this study proposed, are explained in the following (see also Figure 1):

Performance Expectancy (PE) alludes to the belief of an individual in which the use of technology can provide some benefits or result in a performance gain (Thomas et al., 2013; Venkatesh et al., 2003). In the original study, PE was shown to possess the biggest influence on Behavioral Intention (BI), amongst other variables (Khechine et al., 2014; Venkatesh et al., 2003). Its positive relationship with BI was also found in many studies investigating learning technologies (Birch & Irvine, 2009; Salloum & Shaalan, 2018; Thomas et al., 2013); this means that the performance gain expected by students when adopting new learning technologies is an essential aspect of learning technologies implementation. Thus, the first hypothesis is proposed:

H1: Performance Expectancy (PE) has a positive effect on behavioral intention to use distance learning during school closures due to Covid-19

Effort Expectancy (EE) is defined as "the degree of ease associated with the use of new technology" (Venkatesh et al., 2003). This construct was built using the basis of three preexisting variables: complexity, ease of use, and perceived ease of use (Oh et al., 2009; Venkatesh et al., 2003). In this study, EE translates to how easy it is distance learning during school closures is perceived by students, and since not every student has experienced distance or technology-assisted learning, the degree of ease of a distance learning can have a considerable effect on their acceptance of distance learning. A positive relationship between EE and BI was also apparent in many previous studies investigating learning technology (Chau, 2008; Khechine et al., 2014). Thus, the second hypothesis of this study is:

H2: Effort Expectancy (EE) has a positive effect on behavioral intention to use distance learning during school closures due to Covid-19

Social Influence (SI) describes the belief of an individual on how people that are important to them support or endorse the usage of a new system (Venkatesh et al., 2003). SI is found to have a more noticeable effect on BI in earlier stages of technology adoption (Wong et al., 2013). SI was constructed using several root constructs; these constructs include Subjective Norm, Social Factors, and Image. SI affects BI because it alters the perception of an individual of potential status gain and social pressure of using a new technology (Venkatesh et al., 2003). The relationship between SI and BI has proven to be positive in the context of learning technology, such as on the application of the Moodle learning management system as well as an English e-Learning website (Raman et al., 2014; Tan, 2013a). Therefore, the next hypothesis of this study is as follow:

H3: Social Influence (SI) has a positive effect on behavioral intention to use distance learning during school closures due to Covid-19

The last construct from the UTAUT framework is Facilitating Conditions (FC). FC describes users' perception of the existence of organizational and technical infrastructure to support the implementation of new technology (Venkatesh et al., 2003). FC was conceptualized on top of three other preceding constructs: Compatibility, Perceived Behavioral Control, and, Facilitating Conditions. In this study, the organizational and technical infrastructure of FC translates to several aspects such as clear guide and instruction on conducting distance learning, internet access, devices, technical assistance, and other resources in general. In research with the topic of learning technologies, FC was often found to have a positive relationship with BI (Alshehri et al., 2019;

Raman et al., 2014; Lakhal et al., 2013). Thus, in this study, the following hypothesis was proposed:

H4: Facilitating Conditions (FC) has a positive effect on behavioral intention to use distance learning during school closures due to Covid-19

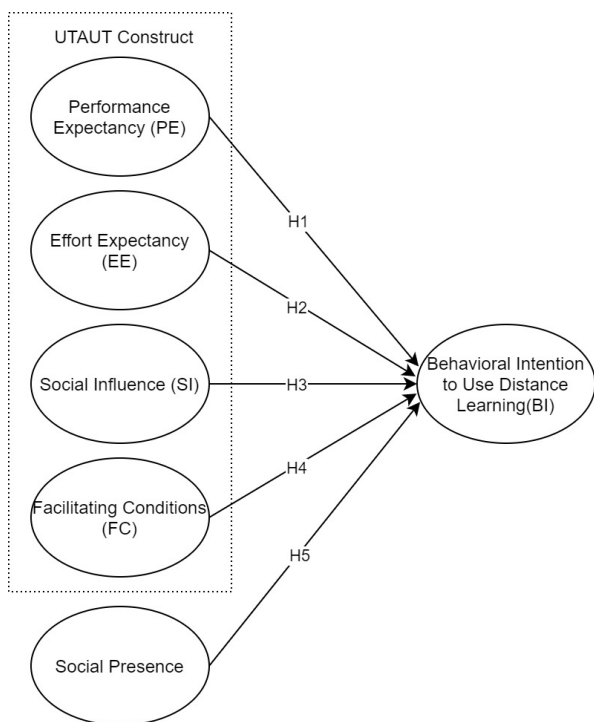


Figure 1 - Theoretical Framework.

Due to the nature of distance learning during school closures, another factor is added to extend the original UTAUT framework. In understanding technology acceptance, factor(s) that is surrounding it is also necessary to consider. Thus, acknowledging that distance learning in this pandemic outbreak can make students' learning experience differs in terms of social interaction, this present study is interested in the Social Presence (SP) construct and its effect on BI. Defined as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships," SP in the context of technology acceptance could also be interpreted more simply as how an individual perceived another individual as a "real person" in a mediated communication (Cai et al., 2019; Nowak & Biocca, 2003). In previous studies, SP has been proven to significantly affect users' acceptance of technology, including learning technologies (Heerink et al., 2008; Mavroidis et al., 2013; Shen, 2012; Smith, 2006). SP effects on BI could also be apparent in the implementation of distance learning during school closures, which heavily focused on telepresence using

platforms such as Zoom. Therefore, the last hypothesis is as follows:

H5: Social Presence (SP) has a positive effect on behavioral intention to use distance learning during school closures due to Covid-19

3. Methodology

3.1 Research Instrument

A questionnaire survey with two sections was used in this study: demographical questions and main questions. Demographical questions ask the respondents' gender, age, education level, and regional origin. The main questions consisted of 29 items corresponding to six different constructs, and each item was measured with a five-point Likert scale that ranges from "Strongly Disagree" to "Strongly Agree." The questions for the present study was mainly based from the work of (Venkatesh et al., 2003) which is original research on UTAUT framework. Questions for Social Presence and additional references for UTAUT's construct was based from these literatures (Gunawardena and Zittle, 1997, Garrison et al., 2010, Shi, 2009, Khechine et al., 2014). Table 1 present the list of the questionnaire items and their corresponding constructs.

Question	Items
I felt comfortable conversing through the distance learning medium(s)	SP1
Distance learning is an excellent medium for social interaction	SP2
The instructor helped keep the distance learning participants on task in a way that helped me to learn	SP3
I felt comfortable participating in the distance learning discussions	SP4
I felt comfortable disagreeing with other distance learning participants while still maintaining a sense of trust	SP5
I felt that my point of view was acknowledged by other distance learning participants	SP6
Using distance learning system will improve my performance in the courses that I took	PE1
I'll find the system useful in my learning activities	PE2
Using distance learning system enables me to accomplish my learning activities more quickly	PE3
Using distance learning system improves the quality of my learning activities	PE4
Using distance learning system makes my learning activities easier	PE5
Using distance learning system enhances my effectiveness in my learning activities	PE6

Using distance learning system increases my productivity in my learning activities	PE7
If I use distance learning, I will increase my chances of getting higher marks on tests and exams	PE8
Learning to use distance learning system will be easy for me	EE1
My interaction with distance learning system will be clear and understandable	EE2
It'll be easy for me to become skillful at using distance learning	EE3
I'll find distance learning system easy to do	EE4
People who influence my behaviour think I should use distance learning	SI1
People who are important to me think I should use distance learning	SI2
The teacher of my courses has been helpful in the use of distance learning system (and its technologies)	SI3
In general, my school/campus has supported the use of distance learning	SI4
I have the resources necessary to use distance learning	FC1
I have the knowledge necessary to use distance learning	FC2
Distance learning system is compatible with other learning systems I use	FC3
A specific person is available for assistance with distance learning system difficulties	FC4
I intend to use distance learning system in future	BI1
I predict I will use distance learning system in future	BI2
I plan to use distance learning system in future	BI3

Table 1 – List of Questionnaire Items.

3.2 Data Collection and Analysis

The survey was distributed online due to Covid-19 school and university closures. The target population of this study is students who experience and are interacting with distance learning technologies. The online survey created using Google Forms was distributed openly to students who are in the target population of this study with the help of a surveyor. The online survey was distributed from 1 April to 31 May 2020. Our surveyor assisted the respondents in filling out the questionnaire and explained the study so that the respondents has sufficient understanding regarding the research and the survey. A non-probabilistic (convenient) sampling method was used to select the sample. This approach was selected since the sampling frame was not available to enable us to conduct a probabilistic approach. Furthermore, limits in resources and urgency of this topic are also key factors. However,

many argue that a non-probabilistic approach for SEM analysis can still provide valid and meaningful results (Cooper et al., 2006; Memon et al., 2017). All data was collected voluntarily, as respondents could refuse to fill the survey.

The data was analyzed using Structural Equation Modelling (SEM). Defined as "A very general statistical modeling technique, which is widely used in the behavioral sciences. It can be viewed as a combination of factor analysis and regression or path analysis" SEM was used in this study to assess the theoretical model presented in Figure 1 and test the hypotheses (Hox & Bechger, 1998). Compared to other methods, SEM has the advantage of being able to simultaneously test a structural and measurement model, which is necessary for understanding the present study's extended UTAUT framework (Head & Ziolkowski, 2012).

4. Results

4.1 Sample Characteristics

We have 156 students participating in this study. Most of the respondents come from Indonesia and are spread across 32 different Indonesian cities. Our surveyor was also able to distribute our survey to 28 foreign students from eight different countries, which include China, Japan, India, Philippines, Vietnam, Egypt, Sri Lanka, and Brunei Darussalam. Almost every respondent is a university student, except for one high school student. Table 2 details the characteristics of the sample in this research.

Gender		
	Frequency	Percent
Female	79	50.6
Male	77	49.4
Education level		
	Frequency	Percent
Bachelor	149	95.6
High School	1	0.6
Master	5	3.2
PhD	1	0.6
Institution experience with distance learning?		
	Frequency	Percent
Maybe	20	12.8
No	13	8.3
Yes	123	78.8

Table 2 – Sample Characteristic.

4.2 Measurement model assessment

Before testing the hypotheses proposed in the theoretical research framework section, an assessment of the measurement model needs to be conducted. Since this study uses Structural Equation Modeling (SEM), a test of reliability, validity, and model fit is required. Table 3 presents the reliability and validity of each construct and the items used in this study. It was apparent that the internal consistency, measured by Cronbach α , of each construct, is above the recommended level of 0.7; this reflects the reliability of the data used in this study (Taber, 2018). Following the reliability test, a validity test was also conducted by assessing Factor Loadings, Composite Reliability (CR), and Average Variance Extracted (AVE); when each measure is above the recommended level: Factor Loadings ≥ 0.5 , CR ≥ 0.7 , and AVE ≥ 0.5 (Fornell & Larcker, 1981), the data can be considered valid. The result of this study, as shown in Table 3, revealed that all measures are showing acceptable values. Lastly, a model fit test was done to assess the fitness of the model with the data. Several measures, such as GFI, RMSEA, and CMIN/df were used with acceptable values of ≥ 0.8 , ≤ 0.12 , and ≤ 5 . Each measures also showing acceptable values: GFI = 0.8, RMSEA = 0.12, and CMIN/df = 3.366 (Hooper et al., 2008; Hsu & Lin, 2008; Sexton et al., 2006; Seyal et al., 2002).

Construct	Cronbach α	CR	AVE	Items	Factor Loadings
PE	0.89	0.89	0.6	PE1	0.72
				PE4	0.81
				PE5	0.70
				PE6	0.79
				PE7	0.87
EE	0.82	0.78	0.5	EE1	0.71
				EE2	0.54
				EE3	0.76
				EE4	0.73
SI	0.88	0.86	0.8	SI1	0.91
				SI2	0.86
FC	0.70	0.72	0.5	FC1	0.52
				FC2	0.78
				FC3	0.72
SP	0.79	0.80	0.5	SP1	0.53
				SP4	0.88
				SP5	0.60
				SP6	0.65
BI	0.88	0.81	0.6	BI1	0.78
				BI2	0.86
				BI3	0.66

Table 3 – Reliability and Validity.

4.3 Hypothesis Testing

After the measurement model has been examined and is found to be appropriate, the research hypotheses were then tested. SEM can detail the association between variables in a structural model. Therefore, the theoretical framework proposed in this study was examined to reveal each causal relationship as proposed in our hypotheses (see Figure 1). Table 4 summarizes the result of our hypotheses, as indicated by t-value, p-value, and standardized estimates. Four of the five hypotheses are supported. Performance Expectancy (H1), Social Influence (H2), Effort Expectancy (H3), and Social Presence (H5) affects behavioral intention. One hypothesis was not supported: Facilitating Conditions did not significantly affect behavioral intention (H4). It can be summarized that all constructs except for Facilitating Conditions (FC) are a significant predictor of students' behavioral intention to use distance learning during school closures due to Covid-19. Furthermore, the structural model also shows that it can explain 50.9% of the total variance (R^2) of behavioral intention.

	Path	Estimate	S.E	C.R	p	Hypothesis
H1	PE→BI	.300	.063	4.737	*	Supported
H2	EE→BI	.372	.079	4.682	*	Supported
H3	SI→BI	.246	.072	3.397	*	Supported
H4	FC→BI	.120	.117	1.030	.303	Not Supported
H5	SP→BI	.296	.079	3.732	*	Supported

* = p < 0.001

Table 4 - Result of Hypothesis Testing.

5. Discussion and Conclusions

5.1 Key findings and practical implications

This study asks what factors that influence students' acceptance of distance learning during school closures due to COVID-19. A UTAUT model, extended with an additional variable that relates strongly to the object of the study (Social Presence), was used to answer this study's research question. Several key findings were found in this study. In H1, consistent with previous studies on distance learning technologies acceptance, we found that Performance Expectancy has a significant effect on Behavioral Intention ($\beta=0.30$, $p<0.001$) (Lakhal et al., 2013; Wang et al., 2010). The result of H1 means that students consider the expected outcomes and the usefulness of a distance learning program before accepting it. Therefore, in the current school closures, a distance learning program manager should weigh in students' opinions on what they perceive as a useful distance learning program. Promoting the benefits of distance learning can also be

done to reinforce the Performance Expectancy perceived by students. In H2, it was found that Effort Expectancy significantly affects Behavioral Intention ($\beta=0.372$, $p<0.001$), which is also consistent with findings of a previous study in related topics (Sultana, 2020; Tan, 2013a). Therefore, since most of the distance learning programs in this current Covid-19 outbreak are dominated by telepresence technologies and cloud-based productivity tools, a distance learning program manager should choose the most user-friendly technologies and platforms. A clear guide and instructions should also be given to students, so there are no hurdles in accessing the distance learning program and, in turn, increasing their acceptance of the program. From the result of H3, it is revealed that Social Influence has a significant positive effect on Behavioral Intention, which is also consistent with previous findings on similar studies ($\beta=0.246$, $p<0.001$) (Lakhal et al., 2013; Wang et al., 2010). That is to say, a student's inclination to accept a distance learning program is also determined by how their social environment thinks about the program; when their social environment endorses a distance learning program, a student will be more inclined to accept it. Thus, schools and distance learning program manager could involve teachers and top students to promote the distance learning program, and in turn, making students more accepting of the program. However, in H4, a nonsignificant relationship was found between Facilitating Conditions and Behavioral Intention ($\beta=0.120$, $p=0.303$). Although this finding contradicts our hypothesis, a possible reason for this is how students nowadays could already have access to appropriate devices and necessary resources needed for distance learning, and thus, making Facilitating Conditions as a less insignificant factor in predicting students' acceptance. The findings from this study also provide evidence that Social Presence (H5), a variable that is introduced in this study to complement UTAUT's factors, affects Behavioral Intention significantly ($\beta=0.296$, $p<0.001$). This finding means that the sense of 'realness' of the instructors and other students in a distance learning program plays a significant role in the students' acceptance of the program. Thus, it is recommended for distance learning program manager to consider the use of telepresence platforms which has a more social features such as Microsoft Teams' Collaborate and third-party application extensions such as Kahoot! that can increase the Social Presence felt by students, and consequently, increase the students' acceptance.

5.2 Implications for research

A core outcome from this study is the development and validation of a conceptual research model that could be used to understand the factors that influence the acceptance of distance learning during school closures.

Furthermore, this study expands the literature on distance learning acceptance by investigating a specific situation (a pandemic outbreak), which alters the nature of the distance learning itself. This study also contributes to the body of knowledge on UTAUT; we extend the model by adding Social Presence as an additional influencing factor of technology acceptance. The extended UTAUT, as conceptualized in this study, can serve as a foundation for further studies investigating distance learning in a socially distant situation. However, there is a limitation: this study only focuses on one aspect of the whole distance learning experience. Other aspects such as asynchronous learning, Learning Management System (LMS) such as Moodle, and mobile learning should also be investigated further in terms of their role in distance learning during and after Covid-19 school closures since their role can also be vital (Amendola & Miceli, 2016; Cinque & Pensieri, 2009).

5.3 Conclusion

The present study has successfully identified the antecedents of students' acceptance of distance learning during school closures due to Covid-19. It was revealed that UTAUT extended with Social Presence is able to explain the influencing factors of students' acceptance. Notably, it was found that Effort Expectancy has the strongest influence on students' acceptance. Thus, schools and distance learning administrator should prioritize the ease of use and user-friendliness of a distance learning program. In addition, Social Presence, which is introduced alongside the UTAUT model, also shows a significant effect on students' acceptance. This implies that the social aspect of a distance learning program plays an important role in students' acceptance, and distance learning program managers should consider this aspect of distance learning. The findings in this study should be considered by schools and distance learning program managers to create a more attractive program and are embraced by students. However, this study has some limitations. Firstly, although our respondents vary in nationality, a larger and more diverse sample can be more favorable to improve the scope and applicability of this study. Secondly, the sample of this study is dominated by university students, which may have different behavior compared to pre-college students. Future research could improve this study by addressing the above limitations and asks different research questions with the same topic; additional variables or different statistical approaches can be used to improve the present study.

References

- ADNAN, M. & ANWAR, K. 2020. Online Learning amid the COVID-19 Pandemic: Students' Perspectives. Online Submission, 2, 45-51. doi: [10.33902/JPSP.2020261309](https://doi.org/10.33902/JPSP.2020261309)
- ALLEN, M., MABRY, E., MATTREY, M., BOURHIS, J., TITSWORTH, S. & BURRELL, N. 2004. Evaluating the effectiveness of distance learning: A comparison using meta-analysis. *Journal of communication*, 54, 402-420. doi: [10.1111/j.1460-2466.2004.tb02636.x](https://doi.org/10.1111/j.1460-2466.2004.tb02636.x)
- ALSHEHRI, A., RUTTER, M. J., & SMITH, S. (2019). An implementation of the UTAUT model for understanding students' perceptions of learning management systems: A study within tertiary institutions in Saudi Arabia. *International Journal of Distance Education Technologies (IJDET)*, 17(3), 1-24. doi: [10.4018/IJDET.2019070101](https://doi.org/10.4018/IJDET.2019070101)
- AMENDOLA, D., & MICELI, C. (2016). Online Physics laboratory for University courses. *Journal of E-Learning and Knowledge Society*, 12(3). doi: [10.20368/1971-8829/1165](https://doi.org/10.20368/1971-8829/1165)
- AMIR, L., TANTI, I., MAHARANI, D. A., WIMARDHANI, Y., JULIA, V., SULIJAYA, B. & PUSPITAWATI, R. 2020. Student Perspective Of Classroom And Distance Learning Method During Covid-19 Pandemic In The Undergraduate Dental Study Program. doi: [10.21203/rs.3.rs-42334/v1](https://doi.org/10.21203/rs.3.rs-42334/v1)
- ANASTASIADES, P. S., FILIPPOUSIS, G., KARVUNIS, L., SIAKAS, S., TOMAZINAKIS, A., GIZA, P. & MASTORAKI, H. 2010. Interactive Videoconferencing for collaborative learning at a distance in the school of 21st century: A case study in elementary schools in Greece. *Computers & Education*, 54, 321-339. doi: [10.1016/j.compedu.2009.08.016](https://doi.org/10.1016/j.compedu.2009.08.016)
- ANDREWS, T. & TYNAN, B. 2012. Distance learners: Connected, mobile and resourceful individuals. *Australasian Journal of Educational Technology*, 28. doi: [10.14742/ajet.828](https://doi.org/10.14742/ajet.828)
- BASILAI, G., DGEBUADZE, M., KANTARIA, M. & CHOKHONELIDZE, G. 2020. Replacing the Classic Learning Form at Universities as an Immediate Response to the COVID-19 Virus Infection in Georgia. *International Journal for Research in Applied Science and Engineering Technology (IJRASET)*, 8, 101-8. doi: [10.22214/ijraset.2020.3021](https://doi.org/10.22214/ijraset.2020.3021)
- BEYTH-MAROM, R., CHAJUT, E., ROCCAS, S. & SAGIV, L. 2003. Internet-assisted versus traditional distance learning environments: factors affecting students' preferences. *Computers & Education*, 41, 65-76. doi: [10.1016/S0360-1315\(03\)00026-5](https://doi.org/10.1016/S0360-1315(03)00026-5)
- BIRCH, A. & IRVINE, V. 2009. Preservice teachers' acceptance of ICT integration in the classroom: applying the UTAUT model. *Educational media international*, 46, 295-315. doi: [10.1080/09523980903387506](https://doi.org/10.1080/09523980903387506)
- BOS, B., WILDER, L., COOK, M. & O'DONNELL, R. 2014. Learning mathematics through Minecraft. *Teaching Children Mathematics*, 21, 56-59. doi: [10.5951/teacchilmath.21.1.0056](https://doi.org/10.5951/teacchilmath.21.1.0056)
- BUI, T.-H., LUONG, D.-H., NGUYEN, X.-A., NGUYEN, H.-L. & NGO, T.-T. 2020. Impact of female students' perceptions on behavioral intention to use video conferencing tools in COVID-19: Data of Vietnam. *Data in Brief*, 106142. doi: [10.1016/j.dib.2020.106142](https://doi.org/10.1016/j.dib.2020.106142)
- CAI, J., YANG, H. H. & GONG, D. Understanding Undergraduates' Adoption of Flipped Learning: Integrating UTAUT and Social Presence. *International Conference on Blended Learning*, 2019. Springer, 9-21. doi: [10.1007/978-3-030-21562-0_2](https://doi.org/10.1007/978-3-030-21562-0_2)
- CHAU, M. 2008. The effects of electronic books designed for children in education.
- CHAWLA, A. 2020. Coronavirus (COVID-19)-'Zoom' Application Boon or Bane. Available at SSRN 3606716. doi: [10.2139/ssrn.3606716](https://doi.org/10.2139/ssrn.3606716)
- CHICK, R. C., CLIFTON, G. T., PEACE, K. M., PROPPER, B. W., HALE, D. F., ALSEIDI, A. A. & VREELAND, T. J. 2020. Using technology to maintain the education of residents during the COVID-19 pandemic. *Journal of Surgical Education*. doi: [10.1016/j.jsurg.2020.03.018](https://doi.org/10.1016/j.jsurg.2020.03.018)
- CHURIYAH, M., SHOLIKHAN, S., FILIANTI, F. & SAKDIYYAH, D. A. 2020. Indonesia Education Readiness Conducting Distance Learning in Covid-19 Pandemic Situation. *International Journal of Multicultural and Multireligious Understanding*, 7, 491-507. doi: [10.18415/ijmmu.v7i6.1833](https://doi.org/10.18415/ijmmu.v7i6.1833)
- CINQUE, M., & PENSIERI, C. (2009). Campus We-Com. University students attitude towards didactical innovation. *Journal of e-learning and knowledge society*, 5(1), 181-189. Doi: [10.20368/1971-8829/305](https://doi.org/10.20368/1971-8829/305)
- COOPER, D. R., SCHINDLER, P. S., & SUN, J. (2006). *Business research methods* (Vol. 9, pp. 1-744). New York: Mcgraw-hill.
- CUSHMAN & WAKEFIELD 2020. GLOBAL ECONOMY REOPENING TRACKER 11 August, 2020.

- DIETRICH, N., KENTHESWARAN, K., AHMADI, A., TEYCHENÉ, J., BESSIÈRE, Y., ALFENORE, S., LABORIE, S. P., BASTOUL, D., LOUBIÈRE, K. & GUIGUI, C. 2020. Attempts, Successes, and Failures of Distance Learning in the Time of COVID-19. *Journal of Chemical Education*. doi: [10.1021/acs.jchemed.0c00717](https://doi.org/10.1021/acs.jchemed.0c00717)
- FORNELL, C. & LARCKER, D. F. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, 18, 39-50. doi: [10.1177/002224378101800104](https://doi.org/10.1177/002224378101800104)
- GARRISON, D. R., CLEVELAND-INNES, M. & FUNG, T. S. 2010. Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *The Internet and higher education*, 13, 31-36. doi: [10.1016/j.iheduc.2009.10.002](https://doi.org/10.1016/j.iheduc.2009.10.002)
- GON, S. & RAWEKAR, A. 2017. Effectivity of E-learning through Whatsapp as a teaching learning tool. *MVP Journal of Medical Science*, 4, 19-25. doi: [10.18311/mvpjms/0/v0/i0/8454](https://doi.org/10.18311/mvpjms/0/v0/i0/8454)
- Google. (2020). *Zoom School - Explore - Google Trends*. <https://trends.google.com/trends/explore?q=zoom%20school>
- GUNAWARDENA, C. N. & ZITTLE, F. J. 1997. Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American journal of distance education*, 11, 8-26. doi: [10.1080/08923649709526970](https://doi.org/10.1080/08923649709526970)
- HANNAY, M. & NEWVINE, T. 2006. Perceptions of distance learning: A comparison of online and traditional learning. *Journal of Online Learning and Teaching*, 2, 1-11.
- HEAD, M. & ZIOLKOWSKI, N. 2012. Understanding student attitudes of mobile phone features: Rethinking adoption through conjoint, cluster and SEM analyses. *Computers in Human Behavior*, 28, 2331-2339. doi: [10.1016/j.chb.2012.07.003](https://doi.org/10.1016/j.chb.2012.07.003)
- HEERINK, M., KRÖSE, B., EVERS, V. & WIELINGA, B. 2008. The influence of social presence on acceptance of a companion robot by older people. doi: [10.14198/JoPha.2008.2.2.05](https://doi.org/10.14198/JoPha.2008.2.2.05)
- HOOPER, D., COUGHLAN, J. & MULLEN, M. R. 2008. Structural equation modelling: Guidelines for determining model fit. *Electronic journal of business research methods*, 6, 53-60.
- HORNBAEK, K. & HERTZUM, M. 2017. Technology acceptance and user experience: A review of the experiential component in HCI. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 24, 1-30. doi: [10.1145/3127358](https://doi.org/10.1145/3127358)
- HOX, J. J. & BECHGER, T. M. 1998. An introduction to structural equation modeling.
- HSU, C.-L. & LIN, J. C.-C. 2008. Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & management*, 45, 65-74. doi: [10.1016/j.im.2007.11.001](https://doi.org/10.1016/j.im.2007.11.001)
- HUANG, R., TLILI, A., CHANG, T.-W., ZHANG, X., NASCIMBENI, F. & BURGOS, D. 2020. Disrupted classes, undisrupted learning during COVID-19 outbreak in China: application of open educational practices and resources. *Smart Learning Environments*, 7, 1-15. doi: [10.1186/s40561-020-00125-8](https://doi.org/10.1186/s40561-020-00125-8)
- KETTLES, N. & VAN BELLE, J.-P. Investigation into the antecedents of autonomous car acceptance using an enhanced UTAUT model. 2019 International Conference on Advances in Big Data, Computing and Data Communication Systems (icABCD), 2019. IEEE, 1-6. doi: [10.1109/ICABCD.2019.8851011](https://doi.org/10.1109/ICABCD.2019.8851011)
- KHECHINE, H., LAKHAL, S., PASCOT, D. & BYTHA, A. 2014. UTAUT model for blended learning: The role of gender and age in the intention to use webinars. *Interdisciplinary Journal of E-Learning and Learning Objects*, 10, 33-52. doi: [10.28945/1994](https://doi.org/10.28945/1994)
- KONDRATOVA, L. 2020. The organization of distance learning of music teachers in the conditions of postgraduate education reforming. *ScienceRise: Pedagogical Education*, 45-49. doi: [10.15587/2519-4984.2020.207401](https://doi.org/10.15587/2519-4984.2020.207401)
- LAKHAL, S., KHECHINE, H. & PASCOT, D. 2013. Student behavioural intentions to use desktop video conferencing in a distance course: integration of autonomy to the UTAUT model. *Journal of Computing in Higher Education*, 25, 93-121. doi: [10.1007/s12528-013-9069-3](https://doi.org/10.1007/s12528-013-9069-3)
- LEWIS, E. E., TAYLOR, L. J., HERMSEN, J. L., MCCARTHY, D. P. & FIEDLER, A. G. 2020. Cardiothoracic education in the time of COVID-19: how I teach it. *The Annals of thoracic surgery*, 110, 362-363. doi: [10.1016/j.athoracsur.2020.04.002](https://doi.org/10.1016/j.athoracsur.2020.04.002)
- MARCHEWKA, J. T. & KOSTIWA, K. 2007. An application of the UTAUT model for understanding student perceptions using course management software. *Communications of the IIMA*, 7, 10.
- MAVROIDIS, I., KARATRANTOU, A., KOUTSOUBA, M., GIOSSOS, Y. & PAPADAKIS, S. 2013. Technology Acceptance

- and Social Presence in Distance Education--A Case Study on the Use of Teleconference at a Postgraduate Course of the Hellenic Open University. *European Journal of Open, Distance and E-learning*, 16, 76-96.
- MEMON, M. A., TING, H., RAMAYAH, T., CHUAH, F., & CHEAH, J. H. (2017). A review of the methodological misconceptions and guidelines related to the application of structural equation modeling: A Malaysian scenario. *Journal of applied structural equation modeling*, 1(1), 1-13.
- MUN, Y. Y. & HWANG, Y. 2003. Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International journal of human-computer studies*, 59, 431-449. doi: [10.1016/S1071-5819\(03\)00114-9](https://doi.org/10.1016/S1071-5819(03)00114-9)
- NOWAK, K. L. & BIOCCA, F. 2003. The effect of the agency and anthropomorphism on users' sense of telepresence, copresence, and social presence in virtual environments. *Presence: Teleoperators & Virtual Environments*, 12, 481-494. doi: [10.1162/105474603322761289](https://doi.org/10.1162/105474603322761289)
- OH, S., LEHTO, X. Y. & PARK, J. 2009. Travelers' intent to use mobile technologies as a function of effort and performance expectancy. *Journal of Hospitality Marketing & Management*, 18, 765-781. doi: [10.1080/19368620903235795](https://doi.org/10.1080/19368620903235795)
- PERSADA, S. F., MIRAJA, B. A., & NADLIFATIN, R. (2019). Understanding the Generation Z Behavior on D-Learning: A Unified Theory of Acceptance and Use of Technology (UTAUT) Approach. *International Journal of Emerging Technologies in Learning*, 14(5).
- RAMAN, A., DON, Y., KHALID, R. & RIZUAN, M. 2014. Usage of learning management system (Moodle) among postgraduate students: UTAUT model. *Asian Social Science*, 10, 186-192. doi: [10.5539/ass.v10n14p186](https://doi.org/10.5539/ass.v10n14p186)
- SALLOUM, S. A. & SHAALAN, K. Factors affecting students' acceptance of e-learning system in higher education using UTAUT and structural equation modeling approaches. *International Conference on Advanced Intelligent Systems and Informatics*, 2018. Springer, 469-480. doi: [10.1007/978-3-319-99010-1_43](https://doi.org/10.1007/978-3-319-99010-1_43)
- SANDARS, J., CORREIA, R., DANKBAAR, M., DE JONG, P., GOH, P. S., HEGE, I., MASTERS, K., OH, S.-Y., PATEL, R. & PREMKUMAR, K. 2020. Twelve tips for rapidly migrating to online learning during the COVID-19 pandemic. *MedEdPublish*, 9. doi: [10.15694/mep.2020.000082.1](https://doi.org/10.15694/mep.2020.000082.1)
- SEXTON, J., HOLZMUELLER, C., PRONOVOST, P., THOMAS, E., MCFERRAN, S., NUNES, J., THOMPSON, D., KNIGHT, A., PENNING, D. & FOX, H. 2006. Variation in caregiver perceptions of teamwork climate in labor and delivery units. *Journal of perinatology*, 26, 463-470. doi: [10.1038/sj.jp.7211556](https://doi.org/10.1038/sj.jp.7211556)
- SEYAL, A. H., RAHMAN, M. N. A. & RAHIM, M. M. 2002. Determinants of academic use of the Internet: a structural equation model. *Behaviour & Information Technology*, 21, 71-86. doi: [10.1080/01449290210123354](https://doi.org/10.1080/01449290210123354)
- SHEN, J. 2012. Social comparison, social presence, and enjoyment in the acceptance of social shopping websites. *Journal of Electronic Commerce Research*, 13, 198.
- SHI, W. An empirical research on users' acceptance of smart phone online application software. 2009 *International Conference on Electronic Commerce and Business Intelligence*, 2009. IEEE, 106-110. doi: [10.1109/ECBI.2009.102](https://doi.org/10.1109/ECBI.2009.102)
- SMITH, J. 2006. The effect of social presence on teacher technology acceptance, continuance intention, and performance in an online teacher professional development course.
- STONE, R. W., GOOD, D. J. & BAKER-EVELETH, L. 2007. The impact of information technology on individual and firm marketing performance. *Behaviour & Information Technology*, 26, 465-482. doi: [10.1080/01449290600571610](https://doi.org/10.1080/01449290600571610)
- Stonebraker, P. W., & Hazeltine, J. E. (2004). Virtual learning effectiveness. *The Learning Organization*.
- TABER, K. S. 2018. The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, 48, 1273-1296. doi: [10.1007/s11165-016-9602-2](https://doi.org/10.1007/s11165-016-9602-2)
- TAN, P. J. B. 2013a. Applying the UTAUT to understand factors affecting the use of English e-learning websites in Taiwan. *Sage Open*, 3, 2158244013503837. doi: [10.1177/2158244013503837](https://doi.org/10.1177/2158244013503837)
- TAN, P. J. B. 2013b. Students' adoptions and attitudes towards electronic placement tests: A UTAUT analysis. *American Journal of Computer Technology and Application*, 1, 14-23.
- TEO, T. 2014. Unpacking teachers' acceptance of technology: Tests of measurement invariance and latent mean differences. *Computers & Education*, 75, 127-135. doi: [10.1016/j.compedu.2014.01.014](https://doi.org/10.1016/j.compedu.2014.01.014)
- TERÄS, M., SUORANTA, J., TERÄS, H. & CURCHER, M. 2020. Post-Covid-19 Education

- and Education Technology 'Solutionism': a Seller's Market. *Postdigital Science and Education*, 1-16. doi: [10.1007/s42438-020-00164-x](https://doi.org/10.1007/s42438-020-00164-x)
- THOMAS, T., SINGH, L. & GAFFAR, K. 2013. The utility of the UTAUT model in explaining mobile learning adoption in higher education in Guyana. *International Journal of Education and Development using ICT*, 9.
- TSAI, S. & MACHADO, P. 2002. E-Learning Basics: Essay: E-learning, online learning, web-based learning, or distance learning: unveiling the ambiguity in current terminology. *eLearn*, 2002, 3. doi: [10.1145/566778.568597](https://doi.org/10.1145/566778.568597)
- TURK, V. 2020. Zoom took over the world. This is what will happen next. *Wired UK*.
- UNESCO. 2020. COVID-19 Impact on Education [Online]. Available: <https://en.unesco.org/covid19/educationresponse> [Accessed 13 August 2020].
- VARALAKSHMI, R. & ARUNACHALAM, K. 2020. COVID 2019-ROLE OF FACULTY MEMBERS TO KEEP MENTAL ACTIVENESS OF STUDENTS. *Asian Journal of Psychiatry*, 51, 102091. doi: [10.1016/j.ajp.2020.102091](https://doi.org/10.1016/j.ajp.2020.102091)
- VENKATESH, V., MORRIS, M. G., DAVIS, G. B. & DAVIS, F. D. 2003. User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478. doi: [10.2307/30036540](https://doi.org/10.2307/30036540)
- WANG, C.-H., LIU, W.-L., TSENG, M.-C. & TSAI, H.-S. 2010. A Study of Taiwanese College Teachers' Acceptance of Distance Learning. *International Journal of Organizational Innovation*, 3.
- WONG, K.-T., TEO, T. & RUSSO, S. 2013. Interactive whiteboard acceptance: Applicability of the UTAUT model to student teachers. *The Asia-Pacific Education Researcher*, 22, 1-10. doi: [10.1007/s40299-012-0001-9](https://doi.org/10.1007/s40299-012-0001-9)
- WORLD HEALTH ORGANIZATION 2020. Coronavirus disease 2019 (COVID-19): situation report, 204.

Distance – Learning Goes Viral: Redefining the Teaching Boundaries in the Transformative Pedagogy Perspective

Laura Branchetti^a, Roberto Capone^{b,1}, Maria Laura Rossi^c

^aUniversity of Milan (Italy)

^bUniversity of Salerno (Italy)

^cUniversity of Parma (Italy)

(submitted: 27/12/2020; accepted: 27/10/2021; published: 10/11/2021)

Abstract

This work analyzes the teaching and educational approach, based on Distance Learning, used in a Mathematics class with Engineering students. Thinking critically about how we worked before the COVID-19 crisis, we try to elaborate on possible ways to overcome linear processes' inertia. The teacher's educational activities and the students' reactions are analyzed in the light of the theory of Transformative Learning. We adopt the theoretical and analytical tools provided by the theory of Interest Dense Situation and the theory of Self-Determination. A qualitative and quantitative analysis was conducted referring to a didactic experiment monitoring various elements through a questionnaire consisting of open-ended and Likert questions and thought closed questions together with the results of the midterm test.

KEYWORDS: Distance Learning, Transformative Learning, Covid-19, Undergraduate Teaching, Intense Dense Situation.

DOI

<https://doi.org/10.20368/1971-8829/1135418>

CITE AS

Branchetti, L., Capone, R., & Rossi, M.L. (2021). Distance – Learning Goes Viral: Redefining the Teaching Boundaries in the Transformative Pedagogy Perspective. *Journal of e-Learning and Knowledge Society*, 17(2), 32-44. <https://doi.org/10.20368/1971-8829/1135418>

1. Introduction

Karl Popper, in his essay “Of Clouds and Clocks: An approach to the problem of rationality and the freedom of man” (Popper, 1966), offers us a caustic and illuminating metaphor, that of clouds and clocks. The former is considered the symbol of variability that cannot be predicted, while the latter represent the paradigm of deterministic perfection that does not permit any indeterminacy.

There are predictable events (watches) and unpredictable ones (clouds) but the behavior of clouds would be just as predictable as that of watches if we knew about clouds as much as we know about watches.

The world of watches is a deterministic, rational, organized, linear world. On the opposite, the world of clouds is irregular, unstable, chaotic, and unpredictable.

Although the analysis of learning contexts always requires adopting a perspective capable of describing and interpreting complex phenomena (Morin, 2000), traditional forms of teaching organization, especially at the university level, are usually characterized by consolidated, predictable, and reassuring mechanisms both for teachers and students. Even with some exceptions, innovation is not easy to promote under normal conditions, and new “certainties” are needed before a change can be introduced. However, there are sometimes events that are so traumatic that they cause a change from a world of watches to a world of clouds and after those it takes a long time to reach an equilibrium which has a rational, structured and predictable shape.

The perception of the scenario we are experiencing nowadays is much more similar to what we might have in front of a gigantic cloud, which is a metaphor of the result of the explosion of the threatening COVID-19 emergency.

“In abstract terms, traditional boundaries between practices suddenly change. New boundaries are formed: physical distance and lack of easy communication and access. However, some boundaries fall away. Erasmus' saying that “space separates body, not minds” gains new meaning five centuries later” (Bakker & Wagner, 2020; p. 1).

¹ corresponding author - email: robertocapone69@gmail.com

We were suddenly faced with a drastic change in our lifestyle and the need to review our needs' priorities. The world of school and university immediately reacted to this situation: all over the world, for the entire duration of suspension of teaching activities in the physical venues, Distance-Learning methods supported by technologies were activated. The problem to face was to invent a new pedagogy and a new way to organize didactics concretely, since people were deeply impacted at the emotional and affective level.

Distance-Learning had to become a “Closeness-Learning” and, in a challenging situation from all points of view - even for teachers -, had to find new ways to allow students to enter into a relationship with other people. Anyway, this particular situation offers an opportunity to question the assumption that Presence-Learning and working synchronously is the best possible way of teaching. With this research, we try to analyze this particular aspect of Distance-Learning, rethinking critically at how we worked before the COVID-19 crisis and elaborating possible ways to overcome linear processes' inertia. We analyze, in this paper, the effect of a didactic-educational approach based on Distance-Learning, used in a Calculus II class with Engineering students in their first year of Bachelor. The teacher's educational activities and the students' reactions are analyzed in the light of the theory of transformative pedagogy (Mezirow, 1997), which will be described in section 3.1, trying to understand if the transformations in didactic can give rise to new teaching-learning methods able to survive the duration of the crisis, or if they are only ephemeral manifestations dictated by contingent needs and destined to decline. In the refinement of the analysis lens, we decided to adopt the theoretical and analytical tools provided by the Interest Dense Situation (IDS) theory (Bikner-Ahsbals, 2004) and the self-determination theory. At first, after describing the teaching choices made by the teacher, we analyzed them in light of the IDS framework to understand how the teacher tried to answer the needs of the students, to make the students feel his presence, and to involve the students in a situation of interest. Later, the same theoretical lens was used to investigate how didactic innovation influenced students from the dialectic point of view between the need to “be present” and that of learning. Data were collected to explore these aspects through online questionnaires and analysis of activities on a social platform. From the students' answers to the questionnaire, an initial confusion for the new approach to study was followed by a natural adaptation to the unique situation in an increasingly serene atmosphere. From the analysis of the dialogues on the platform, students' need to discuss with peers and teachers seems to emerge. Moreover, compared to previous years, it is possible to notice a more significant interaction and willingness to share the difficulties that gradually arise.

The analysis of students' needs in this new context led us to hypothesize that this new method can even have positive effects on learning mathematics. Indeed, the IDS framework introduces a fruitful relationship between the need to feel competent in the discipline and the perception of an interest given by the learning situation. We, therefore, hypothesized that the new need for competence generated by the situation could become an engine for students to keep up with the course and learn to maintain contact, even human, with the teacher and the colleagues. Hence, we decided to compare the results of the course's intermediate test (carried out on May 16th, 2020) with the results of the analogous tests carried out in previous years, when a Blended-Learning methodology had already been adopted. The results generally confirm our hypothesis.

In this paper, we describe in §2 a review of the literature about Distance-Learning; in §3 the theoretical framework of IDES and Transformative-Learning; in §4 the research questions we will try to answer; in §5, the context of the research, the participants, the digital resources used; in §6, the discussion of some protocols analyzed; in §7, the conclusions reached.

2. Distance-Learning: a literature review

Distance-Learning is a didactic methodology consisting of a teacher-learner interaction that does not happen in the presence (Clements et al., 2013; Borba and Linares, 2012). Since one of the earliest attempts in 1728 - this was in the Boston Gazette for “Caleb Philipps, Teacher of the new method of Shorthand”, who sought students who wanted to learn through weekly mailed lessons (Holmberg, 2005) – Distance learning has made significant progress, especially with the advent of the web and the proliferation of information technologies. Nowadays, all over the world, many courses are delivered through Distance-Learning, and entire degree courses can be attended in this way. Courses can be taken in Asynchronous Online Learning (AOL) and Synchronous Online Learning (SOL) modes, depending on the student's needs. The former is learning activities in a web-based environment that provides communication between class members and interaction with the contents in time and place that are flexible according to each individual's convenience. Technologies that enable AOL include email, text messages, blogs, online discussions, wikis, streaming media, or a digital content management system. The latter are learning activities in a web-based environment that allow real-time communication between class members and interaction with the contents. Technologies that enable SOL include text, audio- and/or video-based chat, video conferencing, simultaneous presentations from physically distributed sites, and application sharing. Both these two learning

Communities of practice	Networks of practice
Members meet in presence	The members do not know each other in-person
They are groups which are closely connected within the organization to which they belong	They are groups which are mildly connected within their organization
Strong reciprocity but poor geographical distribution	Weak reciprocity but wide geographical distribution
Mainly direct knowledge flows, both implicit and explicit	Indirect knowledge flows, mediated by explicit technologies

Table 1 - Features of the communities and networks of practice.

ways contributed to the didactic action in this experimentation.

When learning in a social context, each actor of the didactic scene contributes, more or less consciously and voluntarily, to the other's growth. Thus, the act of learning becomes the result of a community of practice, within which each one interacts, participates, and contributes to defining the role of the other and one's own. According to Wenger (1999) the community of practice is a self-organized system articulated across three dimensions:

- The domain – or thematic field is what the members share, in which they participate and can evolve.
- The community is the element that stimulates interactions and sharing ideas.
- The practice is the specific knowledge that is shared and preserved.

In the community of practice, a continuous negotiation of practices and meanings is triggered, since the training-learning path becomes a place of exchange where discussion actions are required.

According to Wenger, in order to perform a task in a community of practice, the following steps must take place:

- *Reification*: to achieve a task collaboratively.
- *Participation*: an action which is at the same time collaborative but equal and personalized.
- *Negotiation of meanings*: a group reflection on what has been carried out.

With Distance-Learning, the idea of community goes beyond the possibility of a physical encounter: it is a virtual community, but the same phases described above are involved. In this case, the community of practice becomes a “network of practice”. Nichani and Hung (2002) speak of a “network of practice” and distinguish it concerning a community of practice described in Table 1. Our conception of the virtual community can be interposed between the two, including both elements of one and the other. We will refer to it as a community of practice via web network. Many studies in Italy have highlighted the importance of integrating traditional teaching with teaching provided via the web or, more generally, through the

use of information technologies (Robutti, 2010; Capone et al., 2017; Taranto et al., 2018).

Studies by Albano and Ferrari have been conducted to contribute to overcome the gap between technology and educational research, as their joint use can provide unparalleled opportunities to address many learning problems related to mathematical concepts and linguistic factors, both metacognitive and non-cognitive (Albano & Ferrari, 2008).

Other studies about online education have analyzed how the learning process might change in e-learning environment, with respect to the involved actors and the relationships among them. In particular they we have considered the implication of the student, that is the interaction-relationship between the learner and the knowledge, structured through situations of action, formulation and validation, which lead the student to the construction of his own knowledge. The impact of digital technologies has consequences since both new actors (e.g., author) and new meaning of existent ones are created. Moreover, they seem to well fit the a-didactical situations (Brousseau, 1998), because they, suitably arranged by the author-tutor and as powerful tools containing knowledge, naturally foster exploration, conjecturing, explanation, verification and proof (Albano, 2005).

More recently, since Distance Learning went viral, there have been many studies conducted internationally. The authors, in another article, analyzed Engagement, Motivation and Participation through a fuzzy cognitive map with university students. They show that Distance Learning is valid as an additional and support methodology but, on the other hand, they highlight the ineffectiveness of completely remote teaching.

Therefore, a teaching method that integrates moments of distance teaching with activities carried out in the presence, in the classroom, or in other university environments, is hoped to be used as soon as the emergency is over: a mix of styles, a fluid flow of knowledge between the physical classroom and the virtual classroom. They call this Integrated Digital Learning. (Capone & Lepore, 2021).

Bakker and colleagues (2021) wondered if the pandemic changed the point of view on the themes of mathematics education research. According to the authors, the pandemic worked as a lens on the already important issues of social and educational problems. For example, designing new teaching approaches, orienting mathematics learning also towards solving social problems such as species extinction, solving climate change, building a sustainable future.

Some authors (Siregar & Siagian, 2021) evaluated the online learning of mathematics highlighting the change of the learning method. They showed the usefulness of online communication media such as whatsapp but also the lack of interaction between instructors and students. Some authors, in several countries around the world, have investigated about distance learning process of teaching during school closure (Azhari and Fajiri, 2021). Some authors highlighted difficulties due to economic factors or teachers' ability to adapt to a quick change in their teaching or difficulties due to limited access to the internet, such as the case of Indonesia.

Others have highlighted that use of different approaches to organizing distance learning during the COVID pandemic. Still others have studied how to make use of resources and laboratory activities with distance learning (Alabdulaziz, 2021).

A special issue is in press (Chan et al., 2021) by Educational Studies in Mathematics, gathering voices from researchers internationally in mathematics education about teaching mathematics during this pandemic. There are indeed many authors who have written in this past year. Ours is intended to be the voice of researchers who, like others, have had to reorganize their teaching by reporting a case study very similar to many other situations that have arisen in the world.

3. Theoretical Background

3.1 The Transformative Learning Theory

According to the Transformative Learning Theory (Mezirow, 1997), learning is the expansion of consciousness by transforming the basic worldview and specific skills of the self. In transformative learning, particular didactic conditions can occur, resulting in the process of “perspective transformation,” which is articulated across three dimensions: a *psychological* dimension which involves changes in the understanding of the self; a *convictional* dimension which involves a revision of the beliefs; a *behavioral* dimension which involves changes in the lifestyle. Jack Mezirow argues that perspective transformation, which leads to transformative learning, usually results from a “confusing dilemma” that is triggered by a life crisis or a major transition, although it may also result from an accumulation of transformations into patterns of

meaning over some time. An essential part of transformative learning is that individuals (both teachers and students) change their frames of reference by critically reflecting on their assumptions and beliefs and consciously implementing and realizing plans that determine new ways of defining their worlds through a rational and analytical process. The learning process is inherently linked to the idea of change, of the evolution of a status. This change includes the student’s educational needs, whose analysis is essential for the effective teaching-learning process. But change is not always a transformation. In this paper, some educational elements of Distance Learning that could lead to a paradigm shift in educational teaching are analyzed, such as, for example, the use of a social platform in the learning curriculum, the use of a platform to manage some moments of university distance learning, the use of a YouTube channel to integrate video lessons with more traditional didactics.

3.2 The Theory of Interest Dense Situation

The Theory of Interest Dense Situation (IDS) (Bikner-Ahsbabs, 2004) provides tools to investigate how didactic innovation has influenced students from the debate between the need of presence and that of learning. The self-determination theory of Deci and Ryan (1985), on which Bikner-Ashbabs’ IDS theory is based, claims that an individual’s well-being is the result of the fulfillment of three basic psychological needs:

- need for *autonomy*: to feel free in each action and feel that one is acting by one’s own will.
- need for *competence*: to believe to be able to act competently in one’s own environment to carry out important tasks.
- need for *relationships*: to seek and develop safe and positive relationships with others in one’s own social context.

In order to analyze the change and understand if a new methodology has the potential to generate transformation, this theoretical lens can be used to show if Distance-Learning is well-positioned to meet the needs that students had before, but also if and how these needs have changed as a result of this experience prolonged over time. The IDS theory recognizes three main elements that foster the emergence of an interesting didactic situation:

1. *involvement*: one after the other the students are involved in the activity (need for relationship);
2. *dynamics of the epistemic process*: one after the other the students construct continuously farther-reaching meanings (need for autonomy);
3. *mathematical valence*: the value of the situation is concerned with mathematics (need for competence).

In a classroom activity, involvement depends on both the teacher and the students' behavior. The teacher can be oriented by his/her expectations related to the topic or by the situation itself. Similarly, students can be influenced by the teacher's expectations or act independently of them. The situations that most effectively let an IDS emerge occur when the teacher lets the situation orient his/her behavior and the students act independently of the teacher's expectations, encouraged to express their ideas.

4. Research Questions

The questions we asked ourselves at the beginning of this research work concerned the impact that the new Distance-Learning has had on the students and how the strategies adopted to deal with the emergency have fulfilled students' needs. Furthermore, we asked ourselves whether the strategy adopted in this emergency can generate a transformation, in Mezirow's perspective, in the structure of a university course in Calculus, in the ways of interaction among students and between teacher and students. In particular, we formulated the following research questions:

What were the main changes between face-to-face teaching and Distance-Learning, in this case study?

To what extent did the new methodology satisfy the three primary needs of autonomy, competence, and relationship, and how much did it affect the students' perception of the quality of the teaching-learning activities and their interaction with the colleagues and the teacher? What aspects of this new modality were recognized as the most useful and transformative students?

To answer the first question, we analyzed the new teaching strategies used by the same teacher (RC, author of the paper) to transform a blended (face-to-face plus e-learning) into a full Distance-Learning course to fulfill the students' needs in this emergency situation. To address the second question, we investigated the factors that more affected them in this sudden change and to which extent such a change resulted in a transformation (Mezirow, 1999), through the students' evaluation of the course, asking them both general questions and specific questions about what changed in their learning. Moreover, we studied the impact of this emergency on their perception of their needs (autonomy, relationships and competence) and the way it evolved during the crisis. Finally, we analyzed how the new ways the teacher fulfilled their needs fed the interactions on the social platform and influenced the results of the mid-term test.

5. The Case Study

5.1 Context

The didactic experimentation involved the students of the first year of Mechanical Engineering and Management Engineering at the University of Salerno, attending the Calculus II course, the course teacher, two Mathematics education researchers and one master's student.

The students who were expected to attend the class were 108 (since they officially participated in the first year); 124 students were asked to login into the platform (also students of the previous years). The average number of students attending the SOL is around 90. Among the 124 students, 86 students answered the questionnaire. The university has provided some students who had socio-economic disadvantages with computers to attend the courses, so we can state that the students who did not participate in the class have not been prevented from doing it because of their condition and personal choice.

The course was carried out during the second semester of the first year, after students had attended and/or taken a Calculus I exam. The course included 90 hours of lessons, divided into 54 hours of theory lessons and 36 hours of training. Other 24 hours of exercises were conducted by the tutors, with students divided into two groups. For some years, the course has adopted a blended teaching approach, to create a student-centered learning environment that takes advantage of information technology and encourages peer collaboration. Furthermore, the emotional aspect contributing to the students' educational success has always been valued to motivate students to manage their learning process autonomously, actively and consciously. The social platform has encouraged interaction between students even in a virtual community. Active teaching-learning methodologies have been implemented. One of those is Just in Time Teaching (JiTT), which consists of exploiting the classroom feedback activities that students carry out at home to improve teaching effectiveness, optimize times during classroom activities, and increase student motivation. If we analyze a cycle of JiTT with the frameworks of IDS and self-determination, both the need for competence and the need for relationships emerge and the dynamics of epistemic processes linked to the autonomous construction of some mathematical concepts. The fact that students feel free to share their answers to the exercises shows that they feel competent on that topic. This is also due to the possibility to discuss the tasks with the teacher and peers. Furthermore, since the exercises assigned at the end of a lecture regard topics not fully introduced yet, a gradual construction of the new issue (dynamics of the epistemic process in the IDS) is reached. In recent years, several experiments have been conducted to

improve the teaching action's effectiveness. In particular, in the academic year 2016/17, a blended teaching model was tested with a half-flipped teaching in the SCALE-UP learning environment (Branchetti et al., 2018). In the academic year 2017/18, a blended teaching was tested using the Just in Time Teaching and Peer-Led Team Learning methodologies integrated with the use of a social platform (Capone, 2020). In the academic year 2018/19, the experimentation went on using Augmented Reality to address some crucial topics of the mathematics course and evaluating Student Interaction and Participation with Fuzzy Cognitive Maps as a systemic structure model for analyzing critical success factors of the learning system (Capone & Lepore, 2020). This year, because of the pandemic, the teacher's aim slightly changed since his goal was to create an online community of practice to better foster students' mathematical skills while enhancing collaborative learning that would overcome time and distance constraints

5.2 Resources

The following online resources have been used: custom adaptive e-learning platform (D'Aniello et al. 2020a), Microsoft Teams, Doceri, Edmodo, the teacher's website, the teacher's YouTube channel, Geogebra AR. Some of these have already been used in previous courses as a support for face-to-face teaching. The lessons were delivered on the Microsoft Teams platform, keeping the lessons' time duration and the teaching content unchanged, but providing for more breaks during the lesson and trying to interact as much as possible with the students. The exercise sessions were conducted by dividing the students into virtual subclasses to interact with the small groups' colleagues. Simultaneously, the teacher could intervene in the various classes with coaching and scaffolding actions. Despite the impossibility of the physical meeting, it was considered important that students had the opportunity to interact and discuss with peers, following the ideas based on IDS theory. A social platform has been integrated into Teams to communicate with students in a more informal way to make them feel more the "closeness" of the teacher, tutors, and colleagues. Often, the students confronted each other about carrying out the exercises and pointed out their difficulties or commented on the other students' performance. In a non-invasive way, the teacher and tutors had the opportunity to read the comments and analyze the progress of the exercises. Students often allowed us to monitor the students' skills step by step, the difficulties they encountered, and the points to dwell on with more considerable attention. Furthermore, on the teacher's YouTube channel, video clips of the lessons and examples of exercises were uploaded. The Doceri app has been integrated into the Microsoft Teams platform and used as a digital board

to create video clips with solved exercises. Some tools, among those described, were an integral part of the course already in previous years. The tasks assigned to the students described above have been designed to create the conditions for students to face problems from their perspective and in an autonomous way. One of the main goals was to create an online community of practice in which a shared experience connected students to give meaning to their learning experience.

The use of these resources is in accordance with the framework proposed by Bray and Tangney (2016). This approach focuses on the creation of activities that fall within the Transformation space: transformative uses of technology are those which allow significant task redesign (modification) or permit the creation of tasks that would not be possible without the digital tools (redefinition). These aspects have contributed to the implementation of the activities of this course especially as regards the parameter of engagement in learning mathematics.

5.3 Methods

This research is based on both quantitative and qualitative methods. The quantitative analysis concerns the data collected with the closed questions included in a questionnaire addressed to the Calculus II course students at the University of Salerno (Italy) and the mid-term test results submitted to students verifying their skills in mathematics. Furthermore, some quantitative data are collected from the answers to the questionnaire sent to the students via Google Forms.

The multiple-choice ones have been set according to the Likert scale (1932).

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Never	Rarely	Sometimes	Often	Always
Not at all Satisfied	Slightly satisfied	Moderately Satisfied	Very satisfied	Completely Satisfied
(1)	(2)	(3)	(4)	(5)

Table 2 - Likert scales about statements of agreement, frequency and satisfaction.

The qualitative analysis follows a Content Analysis methodology. It is based on protocols derived from the dialogues on the social platform among students and between students and the teacher and the answers to the open-ended questions included in the questionnaire. Indeed, the questionnaire included both open-ended and multiple-choice questions: the former was designed so that the student's emotional state could be inferred; the latter was formulated so that it was possible to deduce elements of appreciation and criticalities of the didactical approach adopted.

The questionnaire was also designed to investigate the fulfilments of the students' needs highlighted by IDS and their perception of the changes due to the pandemic. When referring to students in their first year of university attending a Distance-Learning course, it becomes necessary to identify markers that can be associated with fulfilling the needs of *autonomy*, *competence*, and *relationships*. We decided to make the following choices:

- The need for *relationships*, as in any other age group, is identified by Likert indicators and sentences in the questionnaire, and comments in the social platforms, referring to a good quality of the discussion between teachers and students and among students themselves and the number of messages and interactions between the students.
- The need for *competence* is linked to the need of feeling to be able to face the tasks that are proposed and to the need for accountability in the group, so we looked at the number of interventions of the students in an online discussion about a mathematical task on the platforms and during the lesson (so they felt able to say something relevant about the solution), the number of students attending the mid-test.
- The need for *autonomy* is the most difficult to detect: it can be linked, for example, to personal behaviors declared in the questionnaire, or with a Likert indicator or in an open question, such as concentration, organization of their work, perseverance in the study and their difficulties (that show that a student is acting on one's own will and looks his/her way to face the new situation), personal search for other resources to meet the tasks related to the contents and easy to find for them.

A global marker that we looked at is the number of students who decided to attend the online course (AOL and SOL activities, social platform), compared to the first semester, since we considered it an indicator of the fact that the needs were fulfilled enough to convince the students that the new methodology could be useful for their learning. Indeed, the students were not obliged to attend the SOL lessons, nor for institutional constraints nor because of a lack of AOL materials.

At the beginning of the questionnaire, we asked the students if they had attended the lessons in the first semester and if they were doing the same in this second semester, and if they preferred the SOL and the AOL activities (recorded lessons and interactions on the platforms). The questions concerned the need for autonomy, the need for competence and the need for relationships, and the students' perception of their change. First, we asked an open question concerning their reactions and fears when they were informed of

the new Distance Learning course and another question about how these perceptions changed over the first two months. The questions through which we investigated more precisely the needs were the following.

The questions related to the need for *autonomy* are:

- "From a university point of view, did you think that you would have lost something important for your concentration and ability to organize your study routine?";
- "Has anything changed in terms of concern over concentration and ability to organize your study routine since the beginning of this experience?"

The questions related to the need for *relationships* are:

- "How frequently do you discuss with your colleagues about the course's teaching activities?";
- "From a university point of view, did you think that you would have lost something important for your daily life, your relationships with your classmates and teachers at university?";
- "Since the beginning, has anything changed in terms of the quality of your daily life, of your university relationships with colleagues and teachers?"

The need of *competence* was investigated looking for sentences that were related to the markers we listed above, in particular considering the open answers to the following question:

"If you were asked to suggest something to a teacher about Distance Learning, what would you keep and what would you change to make a student feel more engaged, competent, and trustful in this new modality, also considering your mates' opinions?"

The questions aimed at investigating the students' perception of the change, in psychological, conventional, and behavioral terms, are the following:

"From a university point of view, did you think that you would have lost something important for:

- Your daily life and your relationships with the teacher and the mates?
- Your mood?
- Your concentration and ability to organize your work?
- The quality of your overall training, which would have been better without this experience?
- The quality of the teaching?
- The free time and time devoted to your studies?

For all the previous aspects, we also asked: "Since the beginning, has anything changed?". Some of these elements also emerged from the dialogues among students on the Edmodo platform. As for the analysis of the mathematical competence, we measured it with a mid-term test compared with the one of 2018/19, and

we could also compare them in terms of the results of the two cohorts.

6. Results and Discussion

In this section, data from a qualitative analysis (Sect. 8.1) and a quantitative analysis (Sect. 8.2) are reported highlighting main research findings.

6.1 Quantitative Analysis

First of all, we report some data about the students' participation in our survey, compared to the number of students in the course. Observing the data about the average frequency, we observed not only the same percentages of students attending the lessons but, in the questionnaire, a higher quantity of students answered to have very frequently attended the lessons in the second semester than in the first one (74 in the second semester, 71 in the first one).

A first global observation showed that the physical distance had led students to participate more actively in the educational proposals. For example, we noticed that the interaction among students through the social platform, has been more frequent than in past years. Indeed, the average number of accesses to the platform was much higher this year, 12 in 2018/2019 and is 62 in 2019/2020, while the average number of students attending the lessons was approximately the same in 2018/2019 (calculated using the number of accesses with the badge to the rooms during the lesson time of this course) were 90 on 130, while in 2019/2020 (calculated using the counter on Teams) were 90 on 124. We can thus state that this year, in the emergency, the platforms have become real virtual communities of practice, satisfying the need for interaction and discussion with the peers and the teacher. Moreover, we interpret the large number of interactions concerning mathematical tasks and their solutions, in a context usually devoted to social interaction, as a global indicator of the fulfilment of the need of competence, since the students showed to feel confident to be able to say something relevant and disciplinary grounded about the task proposed by the teacher. We did not find any information about the need of autonomy in this first set of quantitative data. Students' answers to open questions about educational needs follow. When asked how frequently peer discussions were conducted through Distance Learning about the course's teaching activities, 69.77% of students answer 4 or 5 on the Likert scale.

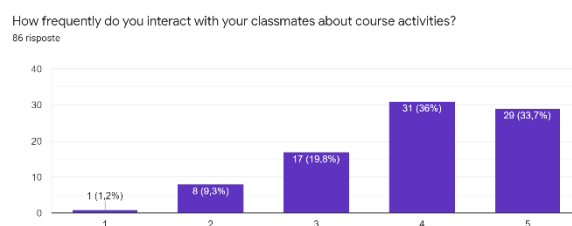


Figure 1: Students' response to the question: How frequently do you interact with your classmate about course activity?

Hence, it emerges that the need for relationships is fulfilled even in Distance-Learning.

Since the teacher has suggested students to exchange their solutions to the exercises, the number of comments under the posts with assigned tasks has increased considerably, so it seems that the students trusted the teacher and appreciated the way he interacted with them and for this reason they accepted to use the interact on the platforms.

In the questionnaire, we asked:

“From a university perspective, you thought you were going to miss something important to:

- your daily life, your relationships at the university with peers and professors
- your mood
- your concentration and ability to organize yourself
- The quality of your overall education, which would have been better without this experience
- teaching quality
- The time studying that would have taken the most time out of your life outside of the university”

Students had to answer each point with a value from 1 to 5.

Focusing on the perception of the impact of the change on the quality of the teaching-learning in the present situation and on the students' careers, at the beginning of the emergency, around 66% of the students thought that the quality of the overall training would have been significantly compromised by the new way to deliver the lessons (4-5); in particular, for 57% of the students, Distance-Learning was a concern especially about the effectiveness and overall quality of the courses, that would have decreased without any corresponding change in the requests during the exams.

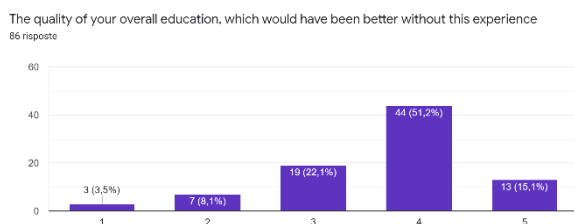


Figure 2 - How the students answer about the quality of their education without the pandemic.

The percentage drops considerably after the start of the course. Students seem to feel reassured that the quality of their education will not be compromised.

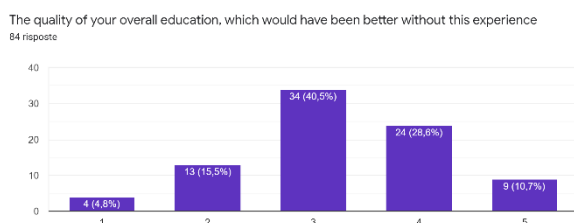


Figure 3 - How the students answer about the quality of their education without the pandemic after the start of lessons.

About the need for autonomy, we report some students' opinions.

When the emergency began, more than half of the students (around 66%) thought they would have lost out both in concentration and organization.

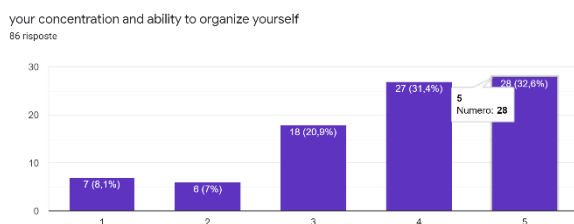


Figure 4 - Students' concerns about concentration and the ability to organize themselves.

We then asked whether, once they had started the course, their perceptions of the above points had changed.

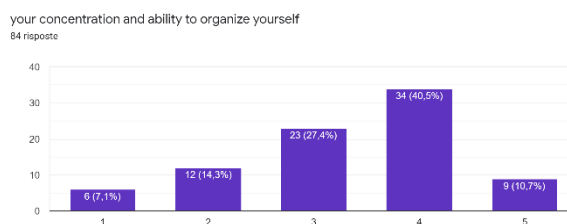


Figure 5 – Students' concerns about concentration and the ability to organize themselves after the start of lessons.

This percentage dropped considerably after a month of Distance-Learning, even if the engagement, according to the students, has dropped.

The need of competence is shown by analyzing the intermediate test results and comparing them with those obtained the previous academic year. An overall improvement of a few percentage points can be observed. The table shows the comparison between the mid-term test results in 2018/2019 and 2019/2020.

Mark	A. Y. 2018/19	A.Y. 2019/2020
Fail	32%	26%
D (Initial)	22%	19%
C (medium)	30%	29%
B (High)	12%	20%
A (Advanced)	4%	6%

Table 3 - Comparison between results of mid-term test in 2018/19 and 2019/20.

This improvement – to be further investigated considering that the student population of the two years is not the same – may be due to a greater fulfillment of the need for competence that is much more intertwined with the need for relationships.

6.2 Qualitative Analysis

Some considerations emerged from the students' open answers in the questionnaire. Here we show some students sentences some of which are repeated by multiple students. The following open-ended questions were asked in the questionnaire and the most significant responses were collected.

1. After experiencing distance learning for the first time, has anything changed from your initial perception? Are you more relaxed or more agitated, and what made you change your mind and feelings eventually?
2. At the moment, how do you feel, what do you feel you have solved and what do you feel you still need to work on in order to be more comfortable in taking classes, dealing with the teacher, dealing with peers and studying?
3. If you were to give some advice to faculty who do distance learning, what would you feel like

suggesting based on this experience you're having, exchanges with other classmates, thinking about different ways faculty have interacted? Is there any that you've found most helpful in making students feel more engaged and more confident, anything that you've found very annoying, etc., and how would you change it?

4. Explain, in a few lines, after having made the reflections suggested by the previous questions, your opinion on the online education referred to the course of Calculus II, highlighting your feelings, the positive aspects and also giving any suggestions to improve the interaction and the quality of lessons and materials.

The students mentioned the need for a relationship as the aspect of Distance learning that was more at risk and one of the leading causes of their fears. From these students' words, it emerged that the main concern at the beginning about Distance-Learning regarded the absence of opportunities for discussion: the students feared that their need for presence and closeness could not be satisfied. Some students' sentences concerning the need for relationships are reported in the following sentences:

Student 1: My worries were related to not being able to discuss with colleagues in the classroom, maybe even at the end of the lesson, as I always did before, and certainly do the same with the teacher.

As soon as the new methodology was imposed, almost 80% thought they would have lost significant terms (4/5) something important for their daily lives and relationships with classmates and teachers. Still, half of them (40%) changed their opinion after two months: even if they confirm in the open answers that they miss the human interaction with the others, their perception about the conservation of the quality relationships with the peers was more positive. Moreover, the fact that the students shared the exercises' solutions on the forums showed they felt competent in the mathematical contents addressed. Hence, it seems to reveal that their need of competence was satisfied by the teacher in this way, since asking questions mirrors a previous reflection on the topic and demonstrates that the students are acting somehow competently, even if they never mentioned it in their sentences. Many students stated that the interactions are more difficult with Distance-Learning and recognize a vital importance to eye and human contact, which cannot be replaced with digital means. However, this concern has changed after an initial period of Distance-Learning. Indeed, they seemed to be satisfied with the atmosphere of calm and serenity perceived during the lessons and with the teachers' dedication to interact with the students, making "the distance less aggressive". This is an example of a students' sentence:

Student 2: I'm getting used to this type of lesson. The difficulties are decreasing. I am more serene because even if some concept is not perfectly clear to me in a synchronous way, I can get excellent explanations from the teacher or listen again to the lesson asynchronously.

The AOL lessons seemed to be appreciated by the students, even if most of them declared to prefer the SOL lessons. Answers like the one given by Student 3 after having lived the Distance-Learning experience show that the possibility of re-watching the lessons and independently recovering the missing passages of the notes is a stimulus for a more profound learning. Given the possibility of re-watching the teacher's theoretical explanations and to discuss on the platform about the assigned exercises, the individual study resulted to be strengthened and enriched. These aspects are also related to the behavioral dimension of transformative learning. Indeed, the difficulties of Distance-Learning have transformed into opportunities to be preserved also as good practices in face-to-face teaching.

Student 3: My concern was that of being penalized from the didactic point of view, given the change we were facing, and the objective difficulties presented by distance lessons, both for us as students and for the teachers. Furthermore, my concern at the beginning also regarded the great veil of uncertainty about the exams.

39% of the students changed their opinion after a few lessons. We found some possible motivation for this change in the answers to the open-ended questions. For instance, a student stated that he felt to be "protected", since the quality of teaching had been preserved, as can be read in the following sentence:

Student 4: Concerning the beginning, I feel more reassured because the teachers have tried as much as possible to take care of the problems due to distance, and they made themselves available. Hence, for the quality of teaching, I feel quite protected. (...)

Moreover, some students pointed out some positive aspects of the new Distance-Learning modality: the embarrassment decreased, which also facilitated the teacher's interactions. The same fact of asking questions or making comments, for example, about an exercise's solution, actually fulfills the need for competence. This attitude can also be interpreted in the light of the psychological dimension of transformative learning: during face-to-face lectures, shyness prevailed and held back students in asking questions and sharing solutions to the exercises, while with Distance-Learning they have gained confidence and awareness of their own abilities, also thanks to the wider availability of time for individual study. This aspect also seems promising from the perspective of reasoning in terms of a change that can transform the students' behavior towards the teacher. This result confirms the teacher's great relevance, both in terms of

satisfying the need of relationship and competence. The two protocols listed above have highlighted that the students encounter more significant difficulties in organizing and staying focused at home:

Student 5: It is a distressing situation. However, attending the lessons online allows us not to lose our everyday life. I am concerned that I cannot stay focused during classes at university.

Let's compare the initial sense of disorientation and the greater serenity after a couple of months. It seems that Distance-Learning has created a new educational equilibrium, giving a new meaning to presence, as is highlighted in the following sentence:

Student 6: I felt disoriented. Not attending the lessons anymore in presence led me to change my routine, aware that the classes would have never been the same again. I had to reorganize myself. At first, I was afraid that the direct relationship between teacher and student would have weakened. It is not easy to communicate with 100 students on an online platform. Another fundamental point is the number of hours spent in front of the computer. Five hours in front of the computer are much more exhausting than 5 hours in the classroom.

Student 7: Of course, online lessons are a great opportunity in this period. They allow us to move forward and, in a certain sense, to distract ourselves in this critical situation...

These sentences seem to reflect the conventional dimension of transformative learning. The initial uncertainties, fears, and distrust toward the effectiveness of Distance-Learning seem to have been softened after having experienced it. These fears led to a revision in terms of their beliefs that led the student to discover that they could accept the new situation, find new resources, and become aware of their needs explicitly and thoughtfully. The students mentioned some problems concerning the SOL lesson in Distance-Learning:

- The perception of the increased rapidity of the lesson.

Student 8: My only concern at the beginning was the fact that, inevitably, distance learning would have seriously compromised the quality of teaching, regardless of the teacher. I notice the main difference is that distance lectures are faster than traditional ones.

- The need of improving the students' autonomy and competence in this new setting.

From the open-ended questions emerges the request to solve the assigned exercises individually and, only after this attempt, to correct them. This request corresponds both to a need for competence, as the students want to feel able to move in their field of study and a need for autonomy.

7. Conclusions

This paper has highlighted how Distance-Learning, already widely adopted in the past, has been characterized in this historical moment with a new meaning. Distance-Learning was essential for strengthening the relationships. In Italy, a note from the Ministry for Education, University and Research delivered on March 17th, 2020, demanded the entire educational community activate Distance-Learning to keep the school communities alive and create a sense of belonging that could face the risk of isolation and demotivation. Due to the pandemic's worldwide spread and its consequences, the learning environments, the teacher-learner relationship and the very organization of teaching times, and the methods for students' assessment had to be restructured. This process had to consider students' needs and requests that are usually not fulfilled with the completion of the course's program. This new form of Closeness-Learning required to make the educational contents functional for an effective learning process, emphasizing their educational value but also taking care of the students' interest and needs since more than ever, the time spent attending the course was for the students a life experience in a dramatic period, where we all got lost and had to reconstruct our relationship with the others, our work, and our daily life. This research had both nomothetic and idiographic goals. On one side, one aim was to shed light on an entirely new educational reality generated by the emergency due to COVID-19. On the other side, we wanted to abstract from this specific situation some elements that could be transferred to different contexts, in particular at the university level. To do this, a qualitative and quantitative analysis was conducted referring to a didactic experiment with a class of Calculus II of the degree program in mechanical and management engineering at the University of Salerno (Italy). Several elements were therefore monitored during the entire course. The students were given a questionnaire consisting of open-ended and Likert questions. The answers to the closed questions and the midterm test results were the quantitative analysis data. The answers to open-ended questions, together with the students' dialogues on the social platforms, have made it possible to make a qualitative analysis of the students' reactions and adaptations and their opinions about this new teaching-learning experience, with the lenses of transformative pedagogy, IDS (based on the theory of self-determination). We observed that the students, in their responses, tried to make comments that could not be interpreted as arguments in favor of transforming the face-to-face or blended version of the course into a Distance-Learning. They demonstrated that they resisted and avoided that this change could become a global transformation of the previous methodology.

However, some elements seem to be useful to integrate with traditional teaching and can be considered transformative: The possibility of reviewing the lessons and having slides and brochures available has given students the confidence and autonomy to refine their notes. Moreover, private messages to the teacher allowed students to have an individual interaction with the teacher, with greater freedom of expression. These elements seem to satisfy the need for relationship and competence. The teacher's role has been instrumental in guiding students to accept changes a little at a time and positively impact student outcomes. After almost two months of Distance-Learning, with lectures delivered on the Teams platform and exercises shared on the Edmodo page of the course, it can be observed that the atmosphere among the students is much more serene than at the beginning when concerns and uncertainties were prevalent. The need which was fulfilled the most was that of relationships: positive connections were developed between the students, who helped and supported each other in solving exercises, and also with the teacher, who was always available to answer doubts and clarification and capable of creating an environment in which students could feel involved. The overall teaching quality does not seem to have been particularly affected: the students feel to be competent in the process of solution of the exercises. We hope that the analysis of students' needs and their fulfillment through Distance-Learning can give rise to unexpected connections. We refer to the relationships that allow access to a client through IT protocols or software. We also refer to synaptic connections able to produce cognition and generate positive emotions that reduce the feeling of being victims in the throes of fear and anguish, making us act in a non-adaptive way. The Distance-Learning, using an oxymoron, became a Presence-Learning. The platform allowed to obviate the lack of face-to-face confrontation, satisfying the primary need for relationships among students and the teacher. We believe that this use of the platform can be an element to be valued even when face-to-face teaching will be reintroduced, to bridge the difficulties due to home-university distance, or to study rooms that are not always designed to support constructive peer discussion. The possibility of participating and sharing solutions in a virtual forum has also stimulated the need for competence, which undoubtedly benefited from the availability of didactic resources and recordings of the lessons. Therefore, it would be desirable to preserve this aspect even when this emergency phase will be overcome, given the close link between the need for competence and a gradual deepening of learning. Undoubtedly, we hope to return to face-to-face teaching. Human values and relationships take on a concrete and visible shape, without completely removing the potentialities that emerged with Distance-Learning but, on the contrary, integrating the two methodologies' strengths.

References

- Alabdulaziz, M. S. (2021). COVID-19 and the use of digital technology in mathematics education. *Education and Information Technologies*, 1-25.
- Albano, G., & Ferrari, P. L. (2008). Integrating technology and research in mathematics education: the case of e-learning. In *Advances in E-learning: Experiences and Methodologies* (pp. 132-148). IGI Global.
- Albano, G. Mathematics and E-Learning: A conceptual framework. *Fourth Congress of ERME, the European Society for Research in Mathematics Education, 17-21 February 2005*, 2005, San Feliu de Guíxols, Spain. 10 p.
- Azhari, B., & Fajri, I. (2021). Distance learning during the COVID-19 pandemic: School closure in Indonesia. *International Journal of Mathematical Education in Science and Technology*, 1-21.
- Bakker, A., Wagner, D. Pandemic: lessons for today and tomorrow? *Educ Stud Math* (2020).
- Bakker, A., Cai, J., & Zenger, L. (2021). Future themes of mathematics education research: an international survey before and during the pandemic. *Educational Studies in Mathematics*, 107(1), 1-24.
- Bardelle, C., Di Martino, P. (2012). E-learning in secondary-tertiary transition in mathematics: for what purpose? *ZDM*, 44(6), 787-800.
- Borba, M. C., Askar, P., Engelbrecht, J., Gadanidis, G., Llinares, S., & Aguilar, M. S. (2016). Blended learning, e-learning and mobile learning in mathematics education. *ZDM*, 48(5), 589-610.
- Bikner-Ahsbabs, A. (2004). Interest-dense situations and their mathematical valences. In *Tenth International Congress in Mathematics Education, Topic Study Group, Copenhagen*. [Online: <http://www.icme-organisers.dk/tsg24/Documents/BiknerAshbabs.doc>].
- Branchetti, L., Capone, R., & Tortoriello, F. S. (2018). Un'esperienza didattica half-flipped in un ambiente di apprendimento SCALE-UP. *Annali online della Didattica e della Formazione Docente*, 9(14), 355-371.
- Bray, A., & Tangney, B. (2016). Enhancing student engagement through the affordances of mobile technology: a 21st century learning perspective on Realistic Mathematics Education. *Mathematics Education Research Journal*, 28(1), 173-197.
- Brousseau, G. (1998). *Théorie des situations didactiques*. Grenoble: La pensée sauvage. Coll. Recherches en didactique des mathématiques.
- Capone, R., De Caterina, P., & Mazza, G. (2017). Blended learning flipped classroom and virtual environment: challenges and opportunities for the 21st century students. In *Proceedings of EDULEARN17 Conference* (pp. 10478-10482).

- Capone, R., Del Regno, F., & Tortoriello, F. (2018). E-Teaching in Mathematics Education: The Teacher's Role in Online Discussion. *Journal of e-Learning and Knowledge Society*, 14(3).
- Capone, R., & Lepore, M. (2020). Augmented Reality to Increase Interaction and Participation: A Case Study of Undergraduate Students in Mathematics Class. In *International Conference on Augmented Reality, Virtual Reality and Computer Graphics* (pp. 185-204). Springer, Cham.
- Capone, R., & Lepore, M. (2021). From Distance Learning to Integrated Digital Learning: A Fuzzy Cognitive Analysis Focused on Engagement, Motivation, and Participation During COVID-19 Pandemic. *Technology, Knowledge and Learning*, 1-31.
- Chan, M., Sabena, C. & Wagner, D. (2021). Mathematics education in a time of crisis—a viral pandemic. *Educational Studies in Mathematics*, (in press).
- D'Aniello, G., De Falco, M., Gaeta, M., & Lepore, M. (2020a). A situation-aware learning system based on fuzzy cognitive maps to increase learner motivation and engagement. In: *Proceedings of the 2020 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)* (pp. 1–8)
- Holmberg, Börje (2005). *The evolution, principles and practices of distance education*. Studien und Berichte der Arbeitsstelle Fernstudienforschung der Carl von Ossietzky Universität Oldenburg [ASF] (in German). 11. Bibliotheks-und Informationssystem der Universität Oldenburg. p. 13
- Holmes, B., & Gardner, J. (2006). *E-learning: Concepts and practice*. Sage.
- Likert R., (1932) "A Technique for the Measurement of Attitudes" *Archives of Psychology*, Vol. 140, No. 55.
- Mezirow, J. (1997). "Transformative Learning: Theory to Practice". *New Directions for Adult and Continuing Education*, 74, 5–12.
- Morin, E., La tête bien faite. (2000). *La testa ben fatta: riforma dell'insegnamento e riforma del pensiero*. Milano: Cortina.
- Nichani M., Hung D., *Can community of practice exist online?* *Educational Technology*, pag. 49 - 54, 2001, vol. 42, n. 4.
- Popper, K. R. (1965). Of clouds and clocks: an approach to the problem of rationality and the freedom of man. *Thinking clearly about psychology: Essays in honor of Paul E. Meehl. Matters of public interest*. University of Washington Press, Seattle, WA, 100-139.
- Robutti, O. (2010). Community of learners with technologies. *Investigação em Educação Matemática*, 51.
- Ruiz, J. G., Candler, C., & Teasdale, T. A. (2007). Peer reviewing e-learning: opportunities, challenges, and solutions. *Academic Medicine*, 82(5), 503-507.
- Siregar, G. M. A., & Siagian, M. D. (2021, May). Evaluation of online learning for mathematics education students. In *Journal of Physics: Conference Series* (Vol. 1882, No. 1, p. 012064). IOP Publishing.
- Taranto, E., Arzarello, F., & Robutti, O. (2018). MOOC as a resource for teachers' collaboration in educational program. In *Proceedings of the re (s) sources 2018 international conference* (pp. 167-170).
- Wenger E., *Communities of practice: the social fabric of a learning organization*, 1996.

From traditional exams to closed-ended quizzes: an exploration towards an effective assessment in mathematics at university level

Giovannina Albano^{a,1}, Agnese Ilaria Telloni^b

^aUniversity of Salerno (Italy)

^bUniversità Politecnica delle Marche (Italy)

(submitted: 11/1/2021; accepted: 27/10/2021; published: 22/11/2021)

Abstract

The pandemic emergency has almost forced the transition from face-to-face to remote evaluation. Starting from the results of the research in Mathematics Education, this exploratory work focuses on how to design effective closed-ended questions of different types, capable of reliably assessing mathematical learning outcomes, especially in terms of the involved competencies. We also investigate how to aggregate the questions into Moodle quizzes able to effectively replace the traditional open written exam. We propose a three-dimensional theoretical model, which takes into account the various types of questions, expected learning outcomes, and mathematical arguments, to shed light on the problems of validity, reliability, balance, and correctness of closed-ended quizzes. We discuss the results of the first implementation of the model within a Linear Algebra course for engineering freshmen.

KEYWORDS: Closed-ended Quiz, Assessment, University, Mathematics, Moodle.

DOI

<https://doi.org/10.20368/1971-8829/1135433>

CITE AS

Albano, G., Telloni, A.I. (2021). From traditional exams to closed-ended quizzes: an exploration towards an effective assessment in mathematics at university level. *Journal of e-Learning and Knowledge Society*, 17(2), 45-55.
<https://doi.org/10.20368/1971-8829/1135433>

1. Introduction

During the last term, we were engaged as teachers of a course concerning Linear Algebra, for Computer Science Engineering freshmen of University of Salerno. Because of the pandemic emergency, we needed to move from face-to-face assessment to distance assessment. This was the occasion to deepen some issues related to computer-based assessment, which have already been treated in some of our previous research. We are familiar with the Moodle platform, which for some years we used to engage students in collaborative activities through the “Workshops”, aimed at promoting a critical attitude in the study of mathematics and at fostering a formative (self-) assessment along the course. Moreover, we made different kinds of resources

available, such as files containing notes, video, and interactive paths for the development of strategic thinking, tailored to the individual learning needs (Telloni, 2020). We had also exploited the opportunities offered by the activity “Quiz” of the Moodle platform, focusing our attention on the automatic formative (self-) assessment as a tool of learning (Albano & Ferrari, 2008, 2013; Albano, Pierri & Sabena, 2020). The pandemic gave rise to the need of effectively using Quiz as a summative assessment tool. The exams at distance offered us the opportunity to deeply reflect on this design.

In this paper, we focus on how to design an effective Moodle quiz, including different types of questions, that can effectively replace the traditional written open-ended exam. The starting point of our research consists of the following working hypothesis: the validity, reliability, balance, and fairness of the traditional assessment consisting of written open-ended questions, integrating operational knowledge and relational knowledge, and addressing the use of representations in various semiotic systems (Skemp, 1976; Duval, 1996).

We are aware that closed-ended questions have some limitations since they do not enable to fully assess the construction of a text, the design of a problem solving process or the argumentative competency (Ferrari, 2019;

¹ corresponding author - email: galbano@unisa.it

Garuti & Martignone, 2019; Trinchero, 2006). However, we believe that the mentioned weaknesses could be contained and largely overcome through a careful design of the questions and the whole quiz.

According to previous research, the design of questions should take into account that the student, in order to give the correct answer, should activate the desired competencies, such as the focused reading of the text, the modeling of the problematic situation, and the coordination of different semiotic systems (Niss & Hogart, 2019). Moreover, the formulation of the questions should discourage improper strategies, such as ruling out items or recurring external resources. Finally, the decay of questions/items should be taken into account, to avoid choosing items by heart. In this respect, it is necessary to continuously vary the questions, hence, to construct a large database, with an attentive choice of the distractors and the systematic use of the option “none of the other answers”, which should be the right option in a significant number of cases. This is aimed to avoid students reaching the correct answers by remembering seen procedures (Darlington, 2014).

This paper focuses on two research questions:

RQ1: how to construct appropriate closed-ended questions able to effectively assess mathematical learning outcomes, according to standards shared by the Academic Community?

RQ2: how to aggregate closed-ended questions in order to construct appropriate quizzes that can replace traditional exams?

This paper is a first exploratory study, referring to the authors' experience during the pandemic, starting from research results in Mathematics Education.

2. Materials and methods

2.1 What should be assessed?

The first issue we addressed was to establish what should be assessed in the specific domain of Linear Algebra. This concerns the *validity* issue, that is the object and the aim of the assessment (Iannone, 2020b). Our perspective aims at the assessment of the competencies, mainly in terms of comprehension and handling of mathematical objects/concepts, their mutual relations, and the processes connected with the problem solving activity. These aspects are deeply taken into account in the traditional exams.

For each item, give appropriate justification.

Let $f: R^4 \rightarrow R^3$ the homomorphism defined by

$$f(x, y, z, t) = (x + 2y - z - 2t, x + y - 2z, -2x - y + 5z + t)$$

- Find the dimension and a basis B of $\text{Ker}(f)$.
- Establish if f is surjective.
- Determine if $(1 - 2, 0) \in \text{Im}(f)$.

Figure 1 - Example of a problem of the traditional exam.

The problem in Figure 1, taken from a traditional exam, addresses some specific educational goals, referring to conceptual knowledge (e.g., definition of the kernel of a homomorphism), calculation skills (e.g. solve a linear system), and mathematical competencies (e.g. mathematical thinking, mathematical problem handling, mathematical communication).

More in general, within the traditional open-ended written exam, the knowledge of several mathematical concepts and calculations skills are addressed, together with some specific mathematical competencies (Niss & Hogart, 2019), such as *mathematical thinking*, *mathematical problem handling*, and *mathematical communication*. It is worth noting that the traditional exam does not call for the *modelling competency* nor the competency about the *use of aids and tools* because they are out of the course's scope and the foreseen exam's modalities.

We started our research by constructing closed questions that covered the same competencies as the traditional exam, giving rise to a list of typical questions. Later, we exploited the identified mathematical competencies in order to create further questions not strictly linked to previous open-ended exams. Indeed, we immediately realized that an exact translation of the traditional written exam into a closed-ended quiz was not possible nor desirable. Instead, the types of questions in the Quiz offered us the opportunity of addressing different aspects of the students' learning, such as their capability of understanding mathematical reasoning, connecting various elements of knowledge, interpreting the meanings of the results of procedures. These features are in line with the suggestions to construct a suitable and effective test for mathematics (Iannone, 2020a), including for instance 'why' questions such as the following.

Does it exist a surjective application $f: R^4 \rightarrow R^3$ such that

$$\text{Ker } f = \{(x, y, z, t) \in R^4 : 2x + 4y + 2z = 4z = 0\}?$$

Choose one or more options

- Yes, because the kernel of f contains only the null vector.
- Yes, because $\dim(\text{Ker } f)=2$.
- No, because $\dim(\text{Ker } f)=2$.
- No, because $\text{Ker } f$ is a vector subspace of R^4 .

Figure 2 - Example of closed “why” question.

The question in Figure 2 and the open question in Figure 1 share knowledge and skills (surjectivity's condition, rank-nullity theorem, and calculation of dimension of the kernel of f), but they differ for the competencies they address. Indeed, the student is asked to connect these elements of knowledge and skills in different settings: in the open question they come into play one at a time in a sequential way, whilst in the closed question they must be recalled and connected at the same time. The question

in Figure 2 asks for something more than item b in Figure 1, related to the issue of the existence of a mathematical object (see, for example, Dubinski, 1997): asking if an application is surjective is different than asking if there is at least a surjective application (in the latter case, the mathematical thinking competency comes into play).

More in general, it is worthwhile to note that in the open-ended questions everyone can follow the preferred solving process to reach the answer, whilst the closed-ended questions require to be able to identify, follow and evaluate the underlying reasoning of the proposed solutions. This is especially the case of Linear Algebra, where multiple solving strategies are allowed to solve a problem (Newton, Star & Lynch, 2010).

In a nutshell, we had evidence that some technical limitations became opportunities from the didactical point of view.

2.2 How to assess mathematical learning outcomes?

According to our choice to use the Moodle Quiz, also due to institutional constraints, we analysed the characteristics of the available question types in order to identify the better fitting between types and competencies to be assessed.

The available literature about computer-based assessment focuses mainly on the multiple-choice question (see for example Watson et al., 2017), but we intended to exploit all the available types of questions in order to capture different abilities and test the students' behaviors. Inspired by the work of Scalise and Gifford (2006), we made an a priori analysis of the potential of different question types with respect to the devised mathematical learning outcomes to be assessed (knowledge, skills, competencies). This gave rise to the graph in Figure 3, where the horizontal dimension collects the core elements of the identified learning outcomes, and the vertical dimension displays the question types. In particular, the core elements are differently colored according to the learning outcomes they refer to: the blue labels regard the knowledge of terms and concepts, the red labels concern the calculation skills, the green labels are linked to the understanding of terms and concepts, the orange labels concern the problem solving capability and the purple labels refer to the capability of reasoning mathematically and explaining the motivations of procedures. The analysis allowed us to highlight the matching between question types and learning outcomes.

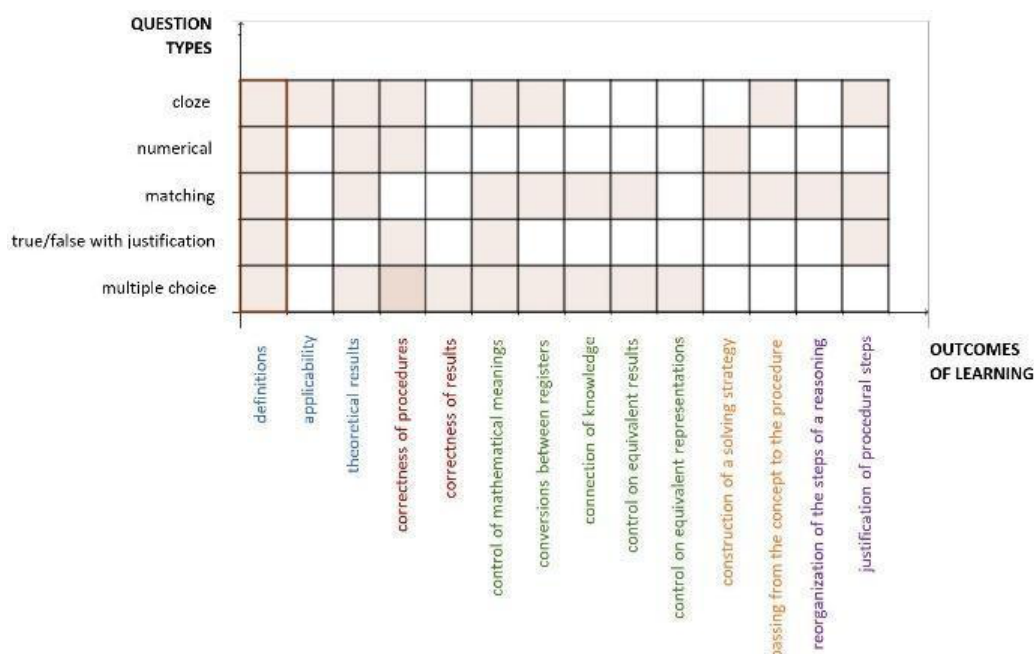


Figure 3 - The matching between question types and learning outcomes.

2.3 How to construct a quiz? The fairness and balance issues

Some issues about the distribution of the questions with respect to different parameters (mathematical content, didactical goal, question type, time) emerged when we needed to construct the quiz. Moreover, the will of realizing strong randomization of the questions determined a further difficulty.

We immediately grasped the need for a theoretical model, enabling us to simultaneously take into account topics, question types and learning outcomes. So, we extended the graph in Figure 3 by adding a further dimension concerning the topics addressed by the questions, giving rise to the three-dimensional model shown in Figure 4.

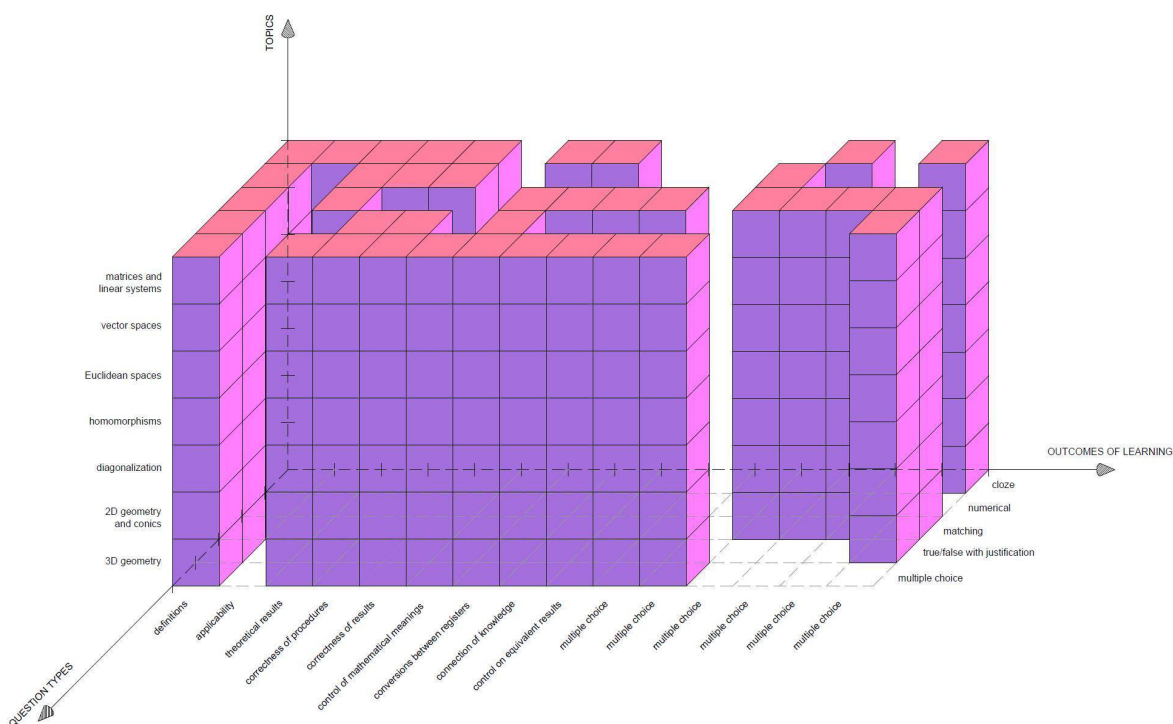


Figure 4 - The three-dimensional model.

We designed a mixed quiz, including open-ended questions and closed questions, in order to monitor the *reliability* of the quiz, that is the outcomes of the assessment in terms of grading (Iannone, 2020b). This was done according to two different aspects: on the one hand, we monitored the reliability of the whole quiz as a tool of assessment and, on the other hand, we looked at the reliability of the closed-ended questions. This is in tune with the split-half method (Chakrabarty, 2013). Indeed, based on our hypothesis about the reliability of the traditional open-ended exam, we could a posteriori gain information about the reliability of the whole quiz as well as of the closed questions, by comparing the average scores. The length of the quiz and the wide spectrum of the addressed topics constitute further features of the quiz which foster the reliability (Livingston, 2018).

The open-ended questions in the quiz are similar to those of the traditional exam, even if the communication of the mathematical contents is more challenging for students. Actually, we chose to set the technical constraint of enabling only textual answers: this way, we could assess the students' capability of justifying the problem solving process in verbal language, either from the theoretical side and the procedural side. More in general, these kinds of questions allow us to assess the conceptual engagement of students with mathematical topics by means of their communications skills (Iannone, 2020a). This aspect is in tune with the definition of *competence*, including the capability of using appropriate linguistic resources with respect to specific functions and aims, as suggested by the Council of the European Union (<https://eur-lex.europa.eu/legal->

[content/EN/TXT/PDF/?uri=CELEX:32018H0604\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&from=EN)).

In constructing the quiz, we needed to take into account technical constraints and didactical needs: indeed, by using the Moodle Quiz, we could not simply randomize along all the three dimensions of the model in Figure 4 (learning outcomes, question types, topics). This induced us to create equivalence classes of quizzes. So, considering the expected number of students for the exam, we created 5 templates of the quiz, so that around 20 students were delivered the same template. All of them share the same structure, where one of the dimensions of the model, that is the question type, is fixed as follows: every quiz contains 2 questions with numerical answers, 3 true-false with justification questions (one is about theoretical issues), 3 multiple-choice questions (one is about theoretical issues), 3 matching questions and 1 cloze question. This choice of giving more importance to the dimension of the model related to the question type is linked to the fairness of the quiz and to the time needed to perform the quiz: we considered that in order to create "equal" quizzes, we needed to include the same number of questions of a specific type. In each template of the quiz, we chose the value of the further dimensions of the model to be set for each question type, i.e., the topic and the learning outcome. So, for example, the 2 numerical questions of our quiz 1 concern vector spaces and address the knowledge of terms/concepts; on the other hand, the 2 numerical questions of our quiz 4 concern matrix and linear systems and address the calculation abilities. Table 1 shows an example of a template.

TEMPLATE 1	TOPIC	LEARNING OUTCOME
NUMERICAL	Vector spaces	Conceptual Knowledge
TRUE/FALSE WITH JUSTIFICATION	Matrices and linear systems	Calculation skills
MULTIPLE CHOICE	Homomorphism	Understanding of conceptual knowledge
MATCHING	2D geometry and conics	Problem-solving capabilities
CLOZE	Diagonalization	Understanding problem-solving process

Table 1 - The matching between question types and learning outcomes.

Corresponding to each cell of the tridimensional model, we created a large database of different questions. This choice underlies the idea of considering to be equivalent the questions associated with the same cell.

2.4 Sample of questions

In this section, we provide some examples of significant closed-ended questions of different types.

Let us start with a matching question (Figure 5), focused on 3D geometry and addressing problem-solving capabilities.

Consider, in the Euclidean space, the Cartesian equation of the plane $ax+by+cz+d=0$. Associate the mathematical conditions corresponding to each given case:

1. Plane which is perpendicular to $x+y+z=1$ and parallel to the z-axis.
2. Plan containing the origin of the axes and perpendicular to $2x+2y+2z-1=0$.
3. Plane containing the point (0,0,1).
4. Plane containing the origin of the axes and parallel to the z-axis.

a = d = 0
 a + b = 0
 c + d = 0
 a + b + c = d = 0

Figure 5 - A matching question on 3D geometry.

In order to successfully answer the question, the student should proceed in a reverse way with respect to classical open-ended questions addressing the same knowledge and calculation skills. In fact, the student should not construct a plane according to some given conditions (parallel to a plane, orthogonal to a line, containing a point, etc.), but he should recognize suitable characteristics on the coefficients of the equation of a generic plane, corresponding to the given conditions. The correct performance depends on a connected knowledge and good control of the geometric and algebraic languages.

Also Figure 6 shows a question about 3D geometry. It is a cloze question, where the items to be chosen are in square brackets, addressing the understanding problem-solving process.

In the Euclidean 3-dimensional space, the linear system $\begin{cases} x + 3y - 8 = 0 \\ 2y + z - 7 = 0, \end{cases}$

represents [a line/a plane], having as [normal/parallel] vector equal to $v=[(3,-1,-2)/(-3,-1,2)/(-3,1-2)]$. The equations of the linear system represent

[orthogonal lines/parallel lines/parallel planes/orthogonal planes], respectively, to the planes $z=0$ and $[y=0/x=0]$. Moreover, the locus

$$\begin{cases} x = -1 - 6t, \\ y = 2 + 2t, \\ z = -4t, \end{cases}$$

the locus represented by since the vector of it, u, [is/is not] parallel to v.

Figure 6 - A cloze question on 3D geometry.

In order to give the correct answers, students should have some knowledge of definitions (i.e., normal/parallel vector) and calculation skills (parallel vector of a line); moreover, they should be able to switch between different semiotic registers.

The close question in Figure 7 concerns diagonalization and addresses understanding of conceptual knowledge.

Consider the real matrix $A = \begin{pmatrix} 0 & 1 & -4 \\ 1 & 2 & 1 \\ -1 & 1 & 0 \end{pmatrix}$. Since A is [symmetric/not symmetric], then it [is/is not] orthogonally diagonalizable. Hence it is [possible/not possible] to deduce that A is also [diagonalizable/not diagonalizable]. In this case, it is [possible/not possible] to calculate the matrix P which orthogonally diagonalizes A by identifying a [orthonormal basis/basis] of all the eigenspaces of A. The matrix P can be constructed by putting as [columns/rows] the vectors of the obtained bases and P turns out to be [an orthogonal/symmetric/diagonal] matrix.

Figure 7 - A cloze question on the diagonalization of matrices.

The question investigated if the student grasped the relation between diagonalization and orthogonal diagonalization, as well as the conceptual existence of the diagonalization matrix P (not only the procedure to construct it).

The following two questions address conceptual knowledge, that is students' understanding of theorems.

The multiple-choice question in Figure 8 proposes items concerning the statement and the proof of Cramer's Theorem. Items 2 and 5 require the student to have gone into depth and to be able to explain the steps of the proof in detail.

Consider Cramer's Theorem. Choose the true items (one or more options):

- The hypotheses of the Theorem include a linear system with complete matrix of order n
- The proof exploits the definition of inverse matrix
- In the thesis of the Theorem the n solutions of the linear system are provided
- None of the other items
- In the proof the property of the identity matrix of being the identity element for the matrix multiplication is exploited

Figure 8 - A multiple-choice question on Cramer's Theorem.

The matching question in Figure 9 asks the student to identify which items concern hypotheses and which ones concern the thesis of Steinitz's Lemma.

For each item, establish if it is a hypothesis or a thesis of Steinitz's Lemma.

1. T is a subset of the vector space V
2. B is a basis of V
3. T is a linearly dependent set
4. The number of vectors in T is greater than the number of vectors in a basis of V

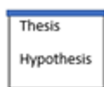


Figure 9 - A matching question on Steinitz's Lemma.

Usually students learn by heart theorems' statements (and often also their proof). This kind of question can affect students' learning style, forcing them to distinguish between hypotheses and thesis, and to be aware of the objects and of the meaning of variables at stake. For instance, item 4 refers to the relationship ' $m > n$ ' appearing in the statement, which is crucial.

The last two examples of questions go beyond the traditional written exams. This kind of issue is usually investigated during the traditional oral exam, but often this level of deepness is neglected, especially in the case of large numbers of students.

2.5 Some implementation details

The questions and the quiz have been implemented using the Quiz module in the platform Moodle.

We exploited some of the standard closed-ended question types: numerical, matching, cloze, and multiple-choice. This last type has been customized as follows:

- a) all the questions appear as multiple-answer questions, both in the case of a single correct answer and in the case of several correct answers. This has been a didactical choice that forces the students to assess each item and aims to avoid them use some inappropriate strategies;
- b) a new category, called 'true/false with justification', has been added. It is a multiple-choice question, foreseeing four answers like 'true because.../false because...'; also in this case there can be more than one correct answer, differing only in the justification. So, identifying the correct answers means to identify the correct pairs (true/false, justification);
- c) the two previous categories have been replicated as new categories, specifying that they concern exclusively the assessment of comprehension of theoretical issues (definition, theorem statements and proofs, theoretical characterizations of a concept from different viewpoints).

We also used the "essay" question type for implementing the open-ended questions.

Moreover, since Moodle allows the teacher to add tags to a question, we exploited this facility in order

to associate each created question with a topic and a learning outcome. So we created:

- a) the tags corresponding to the macro-topics of the course: Matrices and linear systems, vector spaces, Euclidean spaces, homomorphism, eigenvalues and eigenvectors, 2D geometry and conics, 3D geometry;
- b) the tags corresponding to the learning outcomes (see Figure 3).

So two tags have been added to each closed-ended question. Concerning the open-ended ones, we chose to split them into two classes of equivalences, by means of the two tags: algebra and geometry, depending on the content.

The setting up of each quiz has been guided by the template for what concerns the closed-ended part. Random questions have been added, filtering the question bank by tag.

Concerning the quiz layout, the order in which questions appear to the student as well as the order in which the items of the answers to a question appear have been also randomized.

Finally, a lockdown browser has been integrated in Moodle and it is activated when students access the quiz.

3. Results

In this section, we report the results of the first exams' session, just at the end of the course, which was performed by 96 students. The quiz was composed of 13 closed-ended questions and 2 open-ended questions. The best mark for each closed-question has been set to 1, whilst the score of each open-ended question was set to 8.5. In order to pass the exam, it is not sufficient to perform correctly in only one of the two parts of the quiz (close and open). Taking into account the issue of cheating, the team of the department teachers agreed to give around 4 minutes for each closed-ended question and around 20 minutes for each open-ended question, for a total of 90 minutes.

First of all, we will give details about the reliability of the quiz. We will handle the issue at two different levels: comparison with the traditional exams and reliability of the closed-ended questions.

Concerning the first level, we looked at the same session of the last year and we note that the overall percentage of successful students in this first attempt is slightly higher.

We notice that all and only the students who get at least 60% of the maximum open-ended part score, get a global sufficient score as well. This suggests that the mixed exam and the traditional open-ended exam have similar discrimination potential, as desired.

Concerning the second level, we compared the results of the closed-ended part and open-ended part within the

quiz. We observed that the scores of the former are generally slightly better than those of the latter. We compared the percentage of the score obtained in the closed-ended questions with respect to 13 (the maximum score for this part of the quiz), and the percentage of the score obtained in the open-ended questions with respect to 17 (the maximum score for this part). The mean value of the former is 64,8%, whilst the mean value of the latter is 60,4 %, with a gap of 4,4% in favour of the closed-ended part. Going more in depth, focusing on the students who get a sufficient score only to the closed-

ended questions, we note that they did not pass the quiz and they are 16% of the total students.

In the following, in order to deepen the analysis, we will focus on the data of quiz 1.

From the quantitative point of view, the diagram in Figure 10 shows the percentage of the score obtained in quiz 1, with respect to total questions (blu bar), closed-ended (orange bar) and open-ended questions (grey bar). The horizontal green line indicates the sufficient score.

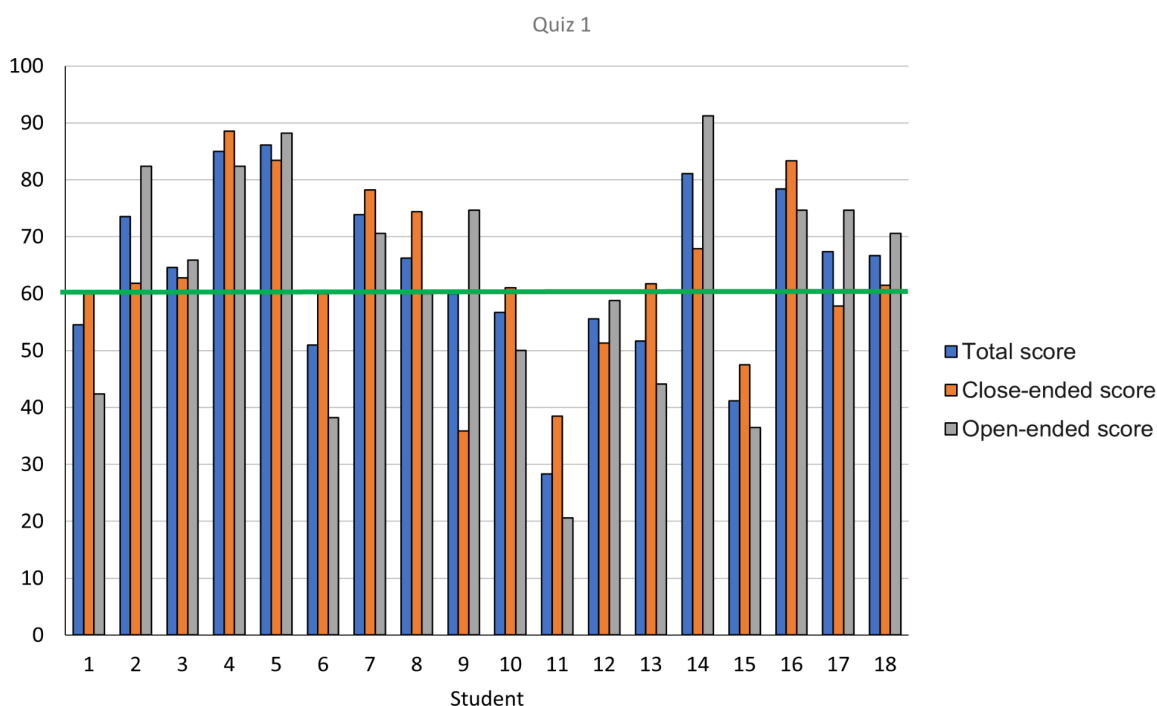


Figure 10 - Data of quiz 1 (whole quiz, closed-ended part, open-ended part).

Taking advantage of the statistics report provided by Moodle, we focus on the facility index, which is the percentage of the students that answered the question correctly². The average facility index of the closed-ended questions is around 62%, whilst the one referred to the open-ended questions is 57%. This suggests that the two types of questions are comparable (as desired). The facility index of the closed-ended questions varies from 31,6% to 93,9%, whilst on the open-ended ones from 44,6% to 69,5%. Although some closed-ended questions require higher competencies (such as connections, as stated previously), it is not surprising that the open-ended questions appear more difficult on average, since the student is required to compose from blank, without any given clue.

There are 11 students who passed the exam.

It is worth noting that three students got the sufficiency to the closed-ended questions, but they did not to the

open-ended ones neither to the total quiz. From now we refer to them as ‘critical students’.

To deepen how to improve the closed-ended questions, we go into qualitative details of the questions which give evidence of students’ difficulties, paying particular attention to the three critical students.

The questions can be grouped according to the kind of learning outcomes they address:

a) *questions concerning the meaning of the rank of a matrix with respect to the context of use.*

Let us see the question in Figure 11. Its facility index is 50%, but all the three critical students selected only wrong items.

² https://docs.moodle.org/310/en/Quiz_statistics_report

Let us consider the homomorphism represented by the matrix

$$A = \begin{pmatrix} 1 & 2 & -1 \\ 0 & 1 & -2 \\ 3 & -3 & 1 \\ 4 & -1 & 5 \end{pmatrix}$$

Choose the correct items:

- The rows of A are linearly dependent
- The domain and the codomain of the homomorphism have the same dimension
- The dimension of Im f is at most 4
- The homomorphism is surjective
- The columns of A form a basis of Im f

Figure 11 - A question concerning the rank of a matrix.

From a procedural point of view, the question involves the computation of the rank of the matrix A, but choosing the correct items requires connecting the concept of rank with various other concepts in different fields, such as the linear dependence/independence of vectors, the basis of a vector space, the kernel and the image of a homomorphism, a matrix representation of a homomorphism.

Similarly, the question in Figure 12 has a facility index equal to 53,3%, and two of the critical students selected some correct items and some incorrect ones, whilst the other critical student did not answer at all. The question concerns the calculation of a matrix representation and its rank; therefore, most of the concepts involved are the same as the previous question. However, the two items require different connections to be answered.

Let us consider the homomorphism defined by

$$f(x, y, z, t) = (2x - y, x + y - 2z, z + t).$$

Choose the correct items:

- f is injective
- The matrix associated to f has 3 rows
- Im f always can be represented through Cartesian equations
- The orthogonal subspace of Ker f has the same dimension of Im f
- The matrix associated to f is square

Figure 12 - A question concerning homomorphisms.

b) *theoretical questions, which can be split into:*

i) questions requiring the concepts' knowledge.

Answering the question in Figure 13 just requires knowing the definition of the counterimage of a vector in a homomorphism. This question has the lowest facility index. It is worth noting that all the three critical students skipped this question, as well as most of the

other students. This can be ascribed to two facts: 1) the presence of a parameter (even if it appears to describe a set of infinity elements); 2) a partial interpretation of the symbol f^{-1} . The latter seems to depend on the students' difficulty in distinguishing, managing, and coordinating the meanings of inverse function and counterimage.

Let f be an endomorphism of R^2 such that

$$f^{-1}(1,2) = (k + 1, 3 - k), k \in R.$$

Choose the correct items:

- $\dim(\text{Ker}f) + \dim(\text{Im}f) = 4$
- $(1,3) \in \text{Ker}f$
- $(1,2) \in \text{Im}f$
- f is an isomorphism
- $\text{Ker}f = \{0\}$

Figure 13 - A question requiring the concepts' knowledge.

Figure 14 shows a question that has often been left blank and whose facility index is equal to 58,33%. The question is about the definition of eigenvectors, although some items can be analyzed independently (e.g. item 4).

Let $v_1 = (1,1,0)$, $v_2 = (0,1,1)$ and $v_3 = (0,0,1)$ be

eigenvectors of the homomorphism $f: R^3 \rightarrow R^3$ associated to the eigenvalues 1, 1, 2, respectively.

Choose the correct items:

- $f(v_1) \neq v_1$
- $f(v_1)$ is the null vector
- $\forall v' \in R^3, f(v') = (x, y, x - y + 2z)$
- v_1, v_2 and v_3 form a basis of R^3
- It is not possible to calculate the linear extension $f(x, y, z)$
- None of the other options

Figure 14 - A question about the definition of eigenvector.

The outcomes of both the above two questions suggest the students' difficulties in managing definitions, which seems to be consistent with a rote and procedural approach to Linear Algebra.

ii) questions requiring the knowledge of theorems.

The question in Figure 15 is based on the theorem about the existence and uniqueness of solutions of a linear system. It concerns the understanding of how the constraints of existence and uniqueness are related to the rank of the matrices associated with the system, rather than to their dimensions. The facility index of the question is equal to 60%. Two of the critical students failed and one skipped the question. The difficulty can

be ascribed to the control of theoretical issues: answering without performing calculations often constitutes an obstacle for students preferring procedural approaches.

- Given a solvable linear system of m equations and n variables ($m \neq n$), does it always have more than one solution?
- Yes, since the coefficient matrix is not square.
- No, since the rank of the coefficient matrix and the rank of the complete matrix could be the same and equal to n .
- Yes, since m and n are different.
- No, because, by hypothesis, it follows that the number of variables is equal to the rank of the coefficient matrix and to the rank of the complete matrix.

Figure 15 - A question about the existence and uniqueness of solutions of a linear system.

c) *questions requiring the management of parameters, connected to the issue of quantifiers.*

The question in fig 16. concerns a square linear system, with non-constant coefficients, depending on the real parameter k . It is clear that the system has a unique solution for all k real, except a finite number of values (corresponding to the zeroes of the determinant of the coefficient matrix). The difficulty of this question can be ascribed to the fact that assessing the correctness of the various proposed items requires managing the relationship between the given values and the universal quantifiers. We underline that the question in Figure 16 foresees two correct answers, corresponding to the first and the third items. The facility index is equal to 33,4% while the percentage of the students who gave the correct answers is 22%, as well as the percentage of the students who skipped the question. All the other students selected only one item, no matter if it was correct or not. This may suggest the doubt that they assumed the uniqueness of the correct answer.

4. Discussion and conclusion

In this paper we address the problem of moving from traditional assessment by written open-ended exams to computer-based assessment by closed-ended quizzes, using Moodle. The choice of the platform has been due also to institutional constraints. While being aware of the limitations of a closed-ended assessment, we faced the issue of constructing questions and assembling quizzes which assessed the same competencies as a traditional open-ended exam. We are also aware of the existence of other computer-aided assessment tools based on computer algebra systems (e.g. STACK, see Sangwin, 2013), which offer the possibility of handling and recognizing (equivalent) algebraic expressions. However, assuming the importance of verbal language in mathematics learning (Ferrari, 2020), we took the

perspective of fully exploiting all available tools. In this respect, we chose to require students to answer in verbal language to the open-ended questions to force their production of written mathematics.

Let us consider the linear system

$$\begin{cases} x + kz = 1 - k \\ y + kz = 0, & k \in R. \\ x + ky + 2z = 0 \end{cases}$$

Does it always have a unique solution?

Choose one or more options.

- No, because for $k = -2$ the rank of the coefficient matrix is not equal to the number of variables.
- Yes, because the determinant of the coefficient matrix does not depend on k .
- No, because for $k = -2$ the rank of the coefficient matrix is different from the rank of the complete matrix.
- Yes, because for $k = 1$ the rank of the coefficient matrix is equal to the number of variables.

Figure 16 - A question concerning a linear system depending on a real parameter.

Various issues emerged, concerning the design of both significant questions and the whole quiz. The change of assessment posed some issues. One of the most relevant is about the possible discrepancy between the way of teaching and the way of assessing. To prevent this, we started with an a priori analysis of the traditional exam. It allowed us to highlight what learning outcomes had been assessed, that means what the students were used to focus on for the assessment, according to the course's teaching style. Further a priori analyses have been devoted to the learning outcomes assessed by the traditional oral exam. They mainly concerned the students' capability of connecting various pieces of knowledge, managing different meanings of the same concept with respect to different contexts, recognizing the theoretical underpinnings to operational procedures, investigating definition or proof comprehension of theoretical results. The analysis made was related to the potential of the various question types offered by Moodle quizzes. This has brought to the emergence of a graph (Figure 3), that highlights the matching between learning outcomes and question types. We implemented the graph, associating each question to a cell of the graph, by means of the Moodle question types and the tagging facility (using learning outcomes as tags). A further tag has been added to the question, specifying the topic the question refers to. The use of the pair of tags (learning outcomes, topic) within a question type gives rise to equivalence classes of questions.

Besides the questions, we also addressed the issue of building the whole quiz, which is a critical issue, in our opinion, not sufficiently addressed in the current literature. In this phase we needed to further develop the

graph and design the three-dimensional model in Figure 4. It takes into account the mathematical topics, in addition to the learning outcomes and the question types. This brought into play the introduction of equivalence classes on the quizzes. We chose to define two quizzes as equivalent if they contain the same number of different question types and aim to assess globally the same set of learning outcomes, whilst the topics can vary. In a few words, two quizzes are equivalent if they correspond to the same block of the three-dimensional model.

The results of the first round of exams show that the students have not been affected by the new assessment method, and this seems to confirm the consistency between teaching and assessment. This is true also in the case of questions which were negatively evaluated, such as the example in Figure 16, requiring the handling of parameters and quantifiers. The same type of difficulty was also found in open-ended questions, such as the question in Figure 17.

Solve in a clear, complete and efficient way the following task, explaining step by step the reasoning and justifying it with appropriate theoretical definitions or results.

Let $f: R^3 \rightarrow R^3$ be the homomorphism defined by

$$f(x, y, z) = (x + hy - z, -y + hz, hx - y + z), \quad h \in R.$$

- Find the dimension and a basis of $(\text{Im}f)^\perp$ when f is not injective.
- Calculate, when it is possible, the inverse matrix of the matrix A associated to f with respect to the canonical bases.
- State the theorem of invertibility of matrices and explain the necessity of the invertibility condition.

Figure 17 - An open-ended question involving a real parameter.

Many students did not correctly solve item b), requiring the handling of the parameter in its generality, and they computed the inverse of A by assigning a fixed value to h .

A further remark concerns the issue of traditional closed-book setting of exams, difficult to realize in the current situation of remote assessment, due to the pandemic (Iannone, 2020a). In our setting, students were required to perform the quiz using a proctoring software, being controlled through a camera. They were also prevented from consulting any knowledge source (books, notes, etc). However, we expected that the questions we designed, requiring connections between different elements of knowledge, changes of semiotic registers and the control on mathematical meanings, could limit the danger of cheating. In this respect, during this term, we are using closed-ended quizzes as informal in-itinere tests, whose positive mark gives the student some 'bonus' for the final exam. The students perform these quizzes at home, without any control, in an 'open-book' setting. The obtained outcomes are comparable to the ones obtained in the 'close-book' setting, shown in this paper. This shed light on the fact that the well-design

of the questions can bring us towards open-book exams. Actually, the quizzes submitted during this term contain new questions, which have been designed based on the on-going analysis of the previous exams' outcomes.

What comes out from this first exploratory study suggest further research questions to be investigated, such as the following:

- looking at the students who had better mark to closed-ended questions than open-ended ones, if and how to define students' profile in mathematics;
- how to exploit the results of closed-ended questions in order to define a hierarchy of question types, learning outcomes and topics according to the students' difficulties made evident from their success or not in correctly answering;
- if and how to use only close-ended questions, especially for what concerns communication skills and activation of linguistic resources;
- how to exploit the item analysis of previous quizzes (in terms of facility index of the single question) in order to a priori evaluate the difficulty level of the quiz and construct fair quizzes;
- carrying out a deepen analysis at two levels (ongoing): at question level, concerning their facility/difficulty and their discrimination potential; at quiz level, concerning the reliability. The analysis of these aspects requires a much bigger question bank as well as much more data coming from quiz sessions.

References

- Albano, G., and Ferrari, P.L. (2008), Integrating Technology and Research in Mathematics Education: The Case of E-Learning, In F.J. García-Peñalvo (Ed.), *Advances in E-Learning: Experiences and Methodologies* (pp.132-148). Hershey, NY: InformationScienceReference.
- Albano, G. and Ferrari, P.L. (2013), Mathematics education and e-learning: meaningful use of the quiz-modules, In E. Faggiano & A. Montone (Eds.). *ICTMT 11 Conference Proceedings* (pp.53-58).
- Albano G., Pi,erri, A. & Sabena, C. (2020), Enhancing formative assessment practices in undergraduate courses by means of online workshops, In: *Proceedings of the 14th International Conference on Technology in Mathematics Teaching – ICTMT 14* DuEPublico, Duisburg-Essen Publications Online (pp. 155-162).
- Chakrabarty, S.N. (2013) Best Split – half and Maximum Reliability, *Journal of Research & Method in Education* 3 (1), 1-8.

- Darlington, E. (2014), Contrasts in mathematical challenges in A-level Mathematics and Further Mathematics, and undergraduate mathematics examinations. *Teaching Mathematics and its Applications*, 3, 213–229.
- Dubinsky, E. (1997), On Learning Quantification, *Journal of Computers in Mathematics and Science Teaching*, 16 (213), 335-362.
- Duval, R. (2006), A cognitive analysis of problems of comprehension in a learning of mathematics, *Educational Studies in Mathematics*, 61, 103-131.
- Ferrari, P.L. (2019), Argomentare a scuola: intrecci fra matematica e lingua, *L'insegnamento della matematica e delle scienze integrate*, vol.42 A-B, n.5, 611-625.
- Ferrari, P.L. (2020). *Educazione matematica, lingua, linguaggi. Costruire, condividere e comunicare matematica in classe*. UTET Università.
- Garuti, R. & Martignone, F. (2019), Assessment and argumentation: an analysis of mathematics standardized items, In: U.T. Jankvist, M. Van den Heuvel-Panhuizen & M. Veldhuis (Eds.). *Proceedings of CERME 11* (pp. 4075-4082) Utrecht: Freudenthal Group & Institute, Utrecht University and ERME.
- Iannone, P. (2020a), Assessing Mathematics at University: Covid-19 and beyond. *London Mathematical Society, Newsletter*, Issue 490, september 2020, 34-40.
- Iannone, P. (2020b), Assessment of mathematics in the digital age: the case of university mathematics. In: A. Donevska-Todorova, E. Faggiano, J. Trgalova, Z. Lavicza, R. Weinhandl, et al. (Eds.), *Proceedings of the Tenth ERME Topic Conference (ETC 10) on Mathematics Education in the Digital Age (MEDA)*.
- Livingston, S. A. (2018). *Test reliability—Basic concepts* (Research Memorandum No. RM-18-01). Princeton, NJ: Educational Testing Service.
- Niss, M., and Højgaard, T. (2019), Mathematical competencies revisited, *Educational Studies in Mathematics*, 102, 9–28.
- Sangwing, C. (2013), *Computer Aided Assessment of Mathematics*, Oxford University Press.
- Scalise, K. and Gifford, B. (2006), Computer-Based Assessment in E-Learning: A Framework for Constructing “Intermediate Constraint” Questions and Tasks for Technology Platforms, *Journal of Technology, Learning, and Assessment*, 4.
- Skemp, R. (1976), Relational understanding and instrumental understanding. *Mathematics Teaching*, 77, 20–26.
- Telloni, A.I. (2021), Design of individualized digital activities fostering strategic planning in linear algebra, In: G. Mele, P. Magnaghi-Delfino & T. Norando (Eds.) *Faces of geometry II. Lectures Notes in Networks and Systems*, 172, pp. 287-298. Springer International Publishing.
- Trincherò, R. (2006), *Valutare l'apprendimento nell'e-learning*, Erickson.
- Watson, K., Wawro, M., Zandieh, M & Kerrigan, S. (2017), Knowledge about student understanding of eigentheory: Information gained from multiple choice extended assessment, *Proceedings of the 20th Annual Conference on Research in Undergraduate Mathematics Education*, pp. 311-325.

COVID-19 Pandemic Endorses New Era of E-learning Case Study: Hashemite University

Sahar Idwan^{a,1}, Ebaa Fayyumi^a, Haneen Hijazi^b, Izzeddin Matar^c

^aDepartment of Computer Science and Applications, Faculty of Prince Al-Hussein Bin Abdallah II for Information Technology, The Hashemite University – Zarqa (Jordan)

^bDepartment of Software Engineering, Faculty of Prince Al-Hussein Bin Abdallah II for Information Technology, The Hashemite University – Zarqa (Jordan)

^cDepartment of Software Engineering, Faculty of Information Technology, University of Petra – Amman (Jordan)

(submitted: 21/12/2020; accepted: 8/12/2021; published: 18/12/2021)

Abstract

Technology has affected the development of the education process over time. COVID-19 pandemic has forced educational facilities to close. Consequently, transformation from face-to-face educational approach to the E-learning approach has pushed the world to enter a new state of learning. This situation has elicited doubts about the implementation and the difficulties related with this immediate action. In this paper, statistical analysis was used on the filled survey by the instructors and students at the Hashemite University (HU) to investigate the quality of the E-learning process. Various factors such as e-content, Virtual Classroom (VC) and Learning Management System (LMS), and Technology Infrastructure affect E-learning process. A contradiction between instructors' and students' opinions regarding the usage of the E-learning at HU exists. Therefore, a set of recommendations was made to overcome the shortage in the E-learning process and to reach a full satisfaction about the quality of its implementation in future.

KEYWORDS: E-Learning, COVID-19, E-Content, Virtual Classroom (VC), Learning Management System (LMS), HU.

DOI

<https://doi.org/10.20368/1971-8829/1135416>

CITE AS

Idwan, S., Fayyumi, E., Hijazi, H., & Matar, I. COVID-19 Pandemic Endorses New Era of E-learning Case Study: Hashemite University. *Journal of e-Learning and Knowledge Society*, 17(2), 56-65.
<https://doi.org/10.20368/1971-8829/1135416>

1. Introduction

COVID-19 has forced people to commit to social distancing to slow down the spreading of the virus which led to drastic changes in our daily lifestyle. All universities globally and specifically in Jordan were closed. At that time, instructors and students were sitting in different locations where they were using various communication technologies to connect with each other. The students and instructors were forced to transfer from face-to-face traditional approach to a fully E-learning approach which showcased the challenges

that students and instructors had to face for the rest of the academic year. This transformation includes moving from the digital resources that are used in the traditional approach to employ one of the different Learning Management Systems (LMSs).

The usage of E-learning in Higher Education Institutes (HEIs) increased rapidly during the last few years, however, it was not commonly used in Jordan (Al-Shboul, Rababah, Al-Saideh, Betawi, & Jabbar, 2013) and (Alkhawaja & Halim, 2019). E-learning has multiple benefits and limitations as listed in Pujari, Sharma, & Jathar (2020), Levine & Sun (2002), Buttar (2016) and Wilp (2020). The process of correctly implementing E-learning required approval from directors and continuous technical support as mentioned in Almarabeh & Mohammad (2013), Raheem & Khan (2020), Nenko, Kybalna, & Snisarenko, (2020), Wargo (2020), Fayyumi, Idwan, AL-Sarayreh, & Obeidallah (2015) and Mahalakshmi & Radha (2020). However, this procedure was not widely used until the lockdown caused by COVID-19.

¹ corresponding author - email: sahar@hu.edu.jo

This has negatively impacted the face-to-face teaching approach and the proper implementation for E-learning was suddenly necessary.

Due to the current pandemic, the need for the E-learning approach dramatically increased. It can be utilized as an alternative solution to provide a high-quality e-content material as well as unceasing communication between the students and their instructors. It provides multiple tools for students to be used to improve their critical thinking skills, leadership, self-motivation and exhibit commitment. The spreading of COVID-19 raised the sudden demand to this change for all majors at the Hashemite University (HU). This study aims to address the following research questions during pandemic:

- *Research Question 1: How did the students and instructors practice E-learning principles on daily basis?*
- *Research Question 2: Was the E-learning process at the HU enhanced by evaluating the current situation and estimating different kinds of shortages to overcome them in future?*

To answer these questions, we investigated the most effective factors in the E-learning process from the students' and instructors' perspectives. These factors are e-content, Virtual Classroom (VC) and Learning Management System (LMS), and Technology Infrastructure. The main objective of this paper is to assess the quality of the E-learning process to guarantee that the faculty, students and decision makers were satisfied with this transformation. Since nobody knows when this pandemic will be over, the E-learning approach is considered as a solution to keep the continuity of the educational process during the coming semesters.

This paper is organized as follows: Section 2 presented the literature review. The research method is presented in Section 3. Section 4 illustrated results and discussions. Recommendations and conclusion were illustrated in Section 5 and Section 6, respectively.

2. Literature Review

Information and Communication Technology (ICT) role is rising sharply in today's educational systems all over the globe. The unpredicted transition to E-learning caused by the lockdown during COVID-19 pandemic required ICT to be integrated into education to replace the traditional face-to-face learning overnight in almost all HEIs in the world.

E-learning has many benefits and limitations. Pujari, Sharma, & Jathar (2020) showed the effective use of ICT in higher education world. It inspires students, allows fast communication across geographical distances, develops students' hypertext skills, and stimulates teachers to learn new skills and teaching techniques.

HEIs usually fall in several mistakes while introducing ICT to education. Buttar (2016) presented the technological systems that might be imposed from the top down not involving faculty and students nor considering content availability and students' needs.

Wilp (2020) presented skills to be practiced, new platforms and tools to be used, teaching approaches and learning outcomes to be revised due to COVID-19. Raheem & Khan (2020) reviewed the role of E-learning in COVID-19 crises. The study explored the E-learning tools that have been used in India and many other countries from all over the world during the lockdown period such as China, Turkey and Iraq. Nenko, Kybalna, & Snisarenko (2020) investigated the state of distance learning in Ukrainian HEIs during COVID-19 pandemic; provided types, effectiveness, negative and positive aspects, faced problems and proposed solutions by getting the feedback from students through an online survey. Mahalakshmi & Radha (2020) stated that students have become more comfortable with online education due to the student's interaction with the multimedia content according to their needs, time and commitments while no physical travel is required. Sahu, (2020) highlighted the influence of the COVID-19 outbreak on education and mental health of students and academic staff. Sahu, (2020) raised several questions about shifting from face-to-face to online classes and how would this affect students and instructors without laptops or internet access, universities with poor technological infrastructure, labs and practical courses. Other doubts were also raised about the assessment and evaluation techniques as they should be revised to fit the online mode, difficult to be monitored to prevent cheating, and the labs and practical courses are difficult to be delivered and assessed online.

COVID-19 pandemic enforced HEIs to reimagine teaching, learning delivery, assessment and accreditation. Wargo (2020) recommended that the education should be viewed as mixture of both physical places and digital spaces in order to provide equity of access to higher education. Daniel (2020) provided guidance to teachers and institutions during COVID-19 that addressed several issues such as: remote-teaching preparation addressing students' needs, introducing LMS, developing curricula and designing assessments. Agarwal & Kaushik (2020) recommended to use online learning in the postgraduate training in their institution after the pandemic as they found it feasible and cheap.

The Jordanian government has recognized the importance of integrating E-learning to support education. An E-learning steering committee was formed by the Ministry of Higher Education and Scientific Research (MoHESR) and a national E-learning strategy for higher education in Jordan for the period 2007-2010 was articulated to support HEIs to transform education into high quality, learner-centric

system by embedding E-learning (MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC, 2009).

However, several organizational and cultural challenges hindered the implementation of E-learning at HEIs in Jordan. Fully online education is actually not implemented in Jordan as the MoHESR does not accredit such type of education and requires student's regular attendance in order to get a degree (Al-Shboul, Rababah, Al-Saideh, Betawi, & Jabbar, 2013). Hence, E-learning has been implemented in the universities of Jordan as a supporter for the traditional face-to-face education solely. However, recently the ministry allowed students to take not more than 25% of their credit hours online. Al-Shboul, Rababah, Al-Saideh, Betawi, & Jabbar (2013) illustrated the challenges raised by implementing E-learning at HEIs in Jordan. Also, Alkhawaja & Halim (2019) listed several problems that affected the adoption of E-learning in Jordan such as technical issues, computer illiteracy, poor time management and lack of self-motivation.

The implementation of E-learning should be gradually achieved with patience, encouragement, and continuous technical support (Almarabeh & Mohammad, 2013). However, the lockdown forced by the quarantine did not allow things to go as ideal as that in most HEIs in the world. HEIs needed to convince instructors and students overnight to accept and leverage ICT in education.

The case in the HU was somehow better. The HU is a public university in Jordan, located in Zarqa. The HU is well-known for its leadership in the field of E-learning among its peers in Jordan and Middle East. An E-learning center was established in the early 2007. Several E-learning tools were offered to all faculties to encourage them to practice the learning process via Blackboard LMS, Lectora authoring tool, Tegrity Lecture Capture, and Illuminate Live. Furthermore, several training courses were held to qualify instructors to use these tools professionally. Therefore, several E-learning activities were practiced such as designing e-content for several courses, recording and broadcasting lectures to other universities locally and regionally. Later, HU moved to a customized version of the open-source Moodle LMS. By the year 2019, most of the courses offered by the departments of the university were converted into e-content to support the face-to-face approach. Fayyumi, Idwan, AL-Sarayreh, & Obeidallah (2015) explored the effect of the infrastructure, regulations and rules, e-course, student and instructor factors on the E-learning process at HU. The results showed statistically that all these factors had a medium effect on the E-learning process according to the survey's participants. This indicated that HU has succeeded in mitigating the negative effects of these factors.

3. Materials and Methods

Herein we briefly describe our method in obtaining the argued results by recognizing the target sample and the appropriate statistical tool used to undertake this analysis. The target group in this paper were divided into two categories: Students and Instructors at the HU. These categories represent the main actors in the E-learning process. In general, the instructor depicts the teaching and learning environment by determining the instructional plan of the course that is aligned under the course learning outcomes. Moreover, the instructor is the one who selects the most appropriate LMSs that increase the students' engagement and allow students to use the course material productively. Meanwhile, the students need to be more active during the E-learning process by recognizing the e-content materials, the platform, the different kinds of interactions including quizzes, assignments and other assessment tools.

The questionnaire was answered by 16,383 out of 17,000 students and 382 out of 400 instructors covering all faculties at HU in May 2020. The purpose of the questionnaire was to assess the quality of the E-learning process during COVID-19 pandemic from the perspective of the two primary actors in this process. The rate of the accepted sample was 96.4% for students and 95.5% for instructors. The questionnaire consists of three demographic information while the remaining questions were used to measure the main factors affecting the quality of the E-learning process.

The demographic questions include gender, faculty and scientific degree in the students and instructors survey as shown in Figure 1 and Figure 2, respectively.

Each question in the distributed survey had a possibility of four-point Likert scale. A Likert scale forms opinion due to missing safe 'neutral' option. For example, each of the four responses would have a numerical value as follows: Strongly agree = 4, Agree = 3, Disagree = 2, and Strongly disagree = 1.

The percentage of the evaluation of the E-learning was investigated by itemizing number of factors. These factors play predominant role in the E-learning process as shown in Figure 3. These factors are e-content, VC and LMS, and Technology Infrastructure, as follows:

Technology Infrastructure

In the past five years the telecommunication companies in Jordan positively contributed to the education transformation from the traditional approach to the E-learning approach in schools, colleges and universities (Int@j, 2018). This infrastructure includes high speed internet bandwidth and different communication technologies such as computers, laptops, smart phone, tablets etc.

Virtual Classroom and Learning Management System

The E-learning process is nothing more than a homogenous integration between the LMS and VC. This integration is utilized to upload the required materials and to establish the synchronous or asynchronous communication between the instructors and students. The LMS is a software application that is used for the management, documentation, tracing, and reporting the learning process (Turnbull, Chugh, & Luck, 2019).

Moodle, Blackboard, and MS-teams are examples of LMS. While VC is a digital replica of a traditional classroom where the instructors and students can meet digitally instead of face-to-face. Zoom, Facebook, WhatsApp and Skype are examples of VC.

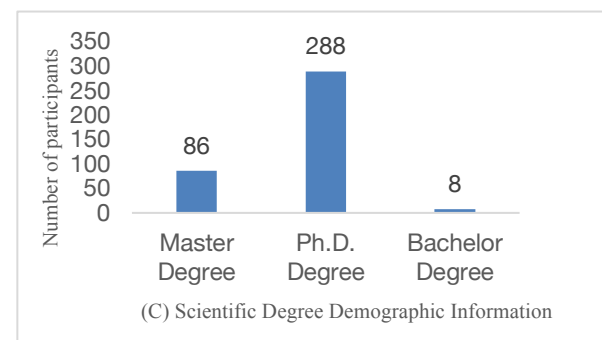
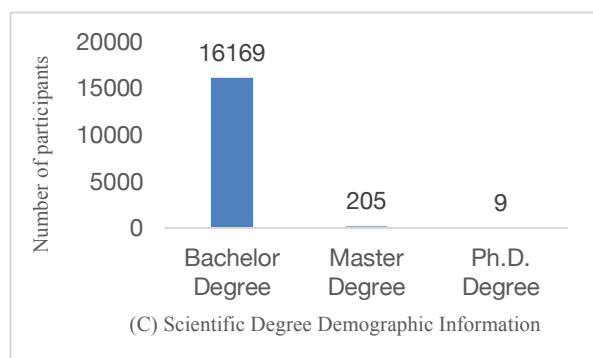
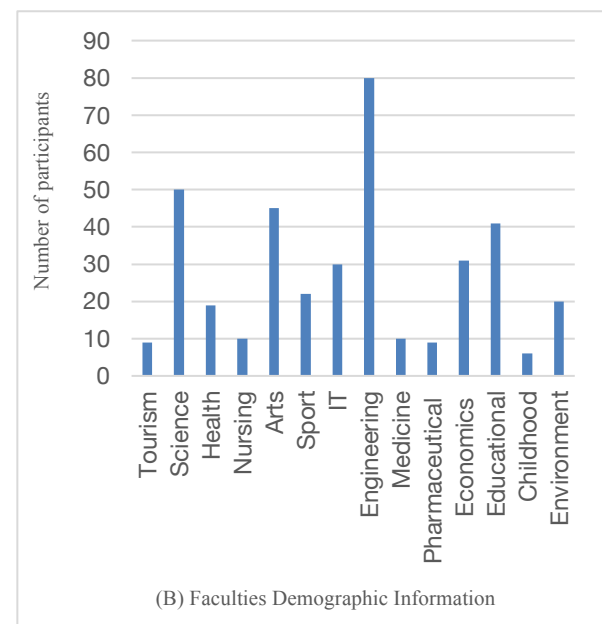
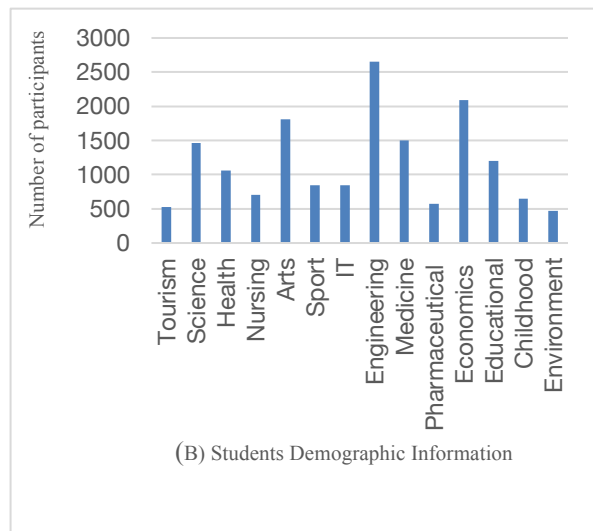
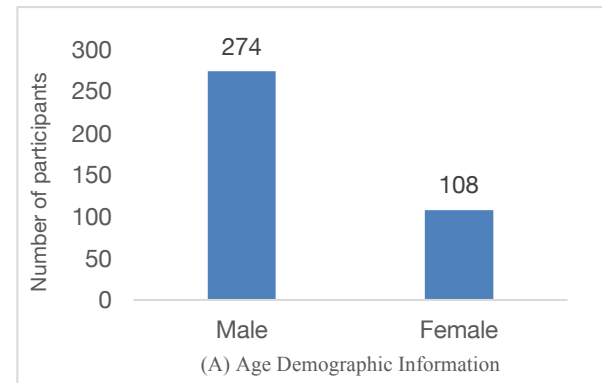
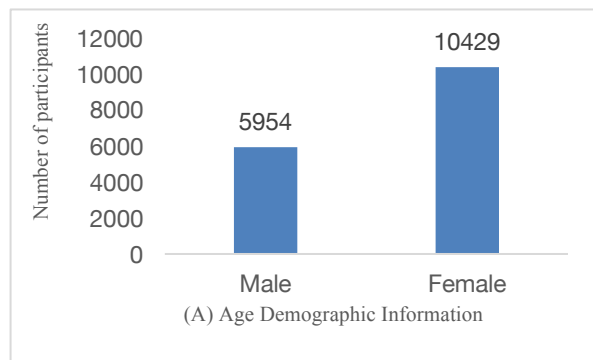


Figure 1 - Demographic information for students at the HU.

Figure 2 - Demographic information for instructors at the HU.

E-content

E-content is a digital transformation of the course content via the internet. It is fundamental to maintain its good quality. This is because, it is the top of the E-learning paradigm as shown in Figure 3 and it plays a key role in achieving not only a complete E-learning process but also preserving its high quality. This transformation requires an expert in the subject area and instructional designer who is responsible to develop the structure and the sequence of the topic in the course.

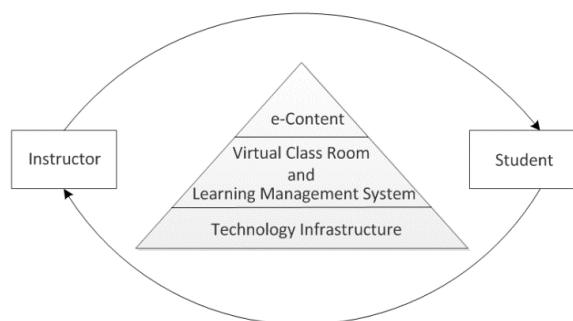


Figure 3 - The most effective factors in the E-learning process at the HU.

4. Results and Discussions

To the best of our knowledge the traditional learning restricts the time and the location. This type of learning is supervised and driven by the instructor regarding running classes, opening discussion, and initiating other activities. On the other hand, the E-learning is a more flexible type of learning, where some of the duties are moved to the students such as getting the education they seek for in their own convenient time and inside their comfortable homes. The statistical analysis of these factors was restrained by a set of criteria such as:

Technology Infrastructure

As mentioned earlier, the technology infrastructure measures the availability of the high-speed internet and the accessibility to different communication devices. Figure 4 shows the students and instructors responses at HU regarding the infrastructure technology factor. It is clearly shown that most students and instructors have a machine/device that was used during the E-learning process with 84.7% and 78.3% respectively. This is due to the escalation in the usage of smart-phones and computers/laptops in Jordan. In addition to that, the transformation to 4G services expands the number of the Internet users that reached up to 88.80% (Int@j, 2018). It's worth mentioning that 15.3% from students and 21.7% from instructors suffer from having their own devices to attend/give and prepare the lectures. This presents a well-known phenomenon that envaded social media and the newspapers at that time which is

the burden on the family to afford a device for each member.

During COVID-19 pandemic, a quick response has been received from the three largest telecommunication companies (Zain, Orange, and Umniah) in Jordan. This was presented by providing affordable internet-bundles for students at universities based on understanding their needs to stay at home. This justifies the obtained results that showed there was no problem with the internet high speed bandwidth as 55.8% from students' perspective. This consequently encourages the student to enroll in the E-learning process, although it contradicts the obtained results in (Sathishkumar, Mahalakshmi, Kumar, & Saravanakumar, 2020). While it presents a problem with 59.2% from the instructors' perspective.

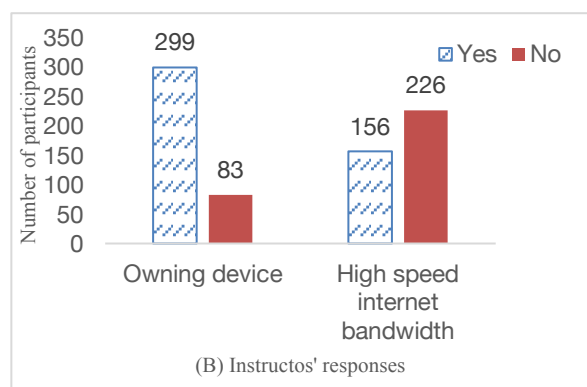
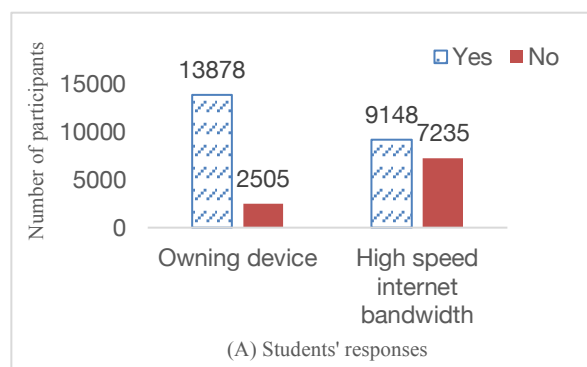


Figure 4 - Technology infrastructure factor.

This refers to non-existing support from the telecommunication companies to instructors during COVID-19 pandemic. Taking in consideration that the instructors have more duties that consume a huge amount of the Internet data usage such as upload the required e-content material and initiate the virtual classes. These low percentage values are not accepted from our point of view due to reductions in the quality of the E-learning process. Further efforts are required from the telecommunication companies in Jordan to guarantee good quality of services to various regions in Jordan.

We found that the perceived results are coherent with the results claimed in (Ferri, Grifoni, & Guzzo, 2020) cross Europe and, in particularly, UK.

Virtual Classroom and Learning Management System

It is well-known that the instructor is the person who is responsible in choosing the most appropriate LMS. He/she uploads course materials to achieve learning goals and prepares assessments, quizzes and tests to estimate the students' progress. The only left task is to determine whether the VC is synchronously or asynchronously to be broadcasted via appropriate tools.

Figure 5 shows the percentage of different used kinds of the VC tools during the pandemic period at the HU. It is clearly shown that MS-teams, Facebook, Zoom and other tools (i.e., WhatsApp and Skype) were used by instructors with 61%, 21%, 7%, and 11% respectively. Our results showed that MS-teams was the prevalent VC tool, while the Zoom is the dominant one in India (Sathishkumar, Mahalakshmi, Kumar, & Saravanakumar, 2020).

Our study intended to examine the differences between the various utilized VC tools in the instructor population by invoking Pearson Chi-Square test. This test informs us that there was a statistically significant difference between the various VC tools. The calculated Chi-square value was equal to 134.241 with an associated significant p-value = 0.000, which is greater than the alpha ($\alpha = 0.05$) to the benefit of MS-teams. The Crisis Management Committee at HU prepared the emergency plan to overcome this pandemic by training the students and instructors by using short videos and tutorials via MS-teams for explaining and exploring different VCs communication. Every single faculty at the HU used all the previous mentioned VC tools with different percentages. The MS-teams were maximally used by Faculty of Pharmaceutical Sciences as 88.9%, while Facebook was maximally used by Queen Rania Faculty of Tourism and Heritage as 77.8%. In the other hand, the Zoom tool was maximally utilized by Prince Al-Hussein Bin Abdullah II Faculty of Information Technology as 36.7%, and the other VC tools were maximally utilized by the Faculty of Engineer.

The VC had been evaluated as a factor that can affect the quality of the whole E-learning process during the pandemic from the perspective of students and instructors. In our study, we compared the students' behavior and the instructors' behavior based on attending/running the virtual classes and the interaction between them. It is important to highlight that the evaluation of the E-learning process from the students' perspectives during the pandemic was 2.32 out of 4.00 as a Low. Moreover, this result is consistent with the students' behavior where the mean value of their synchronous attending to the virtual classes was 2.88 as perceived Average factor where their VC synchronously interaction was 2.21 which exceeds the 76% of the attendees. This indicates that the learning process is smoothly running, and the students are more active in the class. Consequently, this

increased the quality of the E-learning process. It is essential to highlight that the infrastructure factor (device/internet speed) affect the way chosen by students to either attend the class synchronously or asynchronously. On the other hand, the evaluation of the E-learning process from the instructors' perspectives during the pandemic was 3.13 out of 4.00 as an Average. Also, this result is aligned with the instructors' behavior where the mean value of their running the VC was 3.9 as perceived High factor. While their interaction with the students inside the VC was 2.78 as perceived Average factor.

The evaluation of the E-learning process during the pandemic is classified as Low perceived factor in our results as well as many other obtained results such as (Mahyoub, 2020), (Berezhna & Prokopenko, 2020), and (Marinoni, Land, & Jensen, 2020).

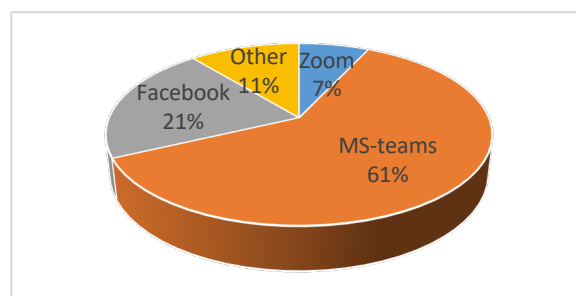


Figure 5 - The percentage of different used of VC tools during the pandemic period at the HU.

E-content

It is worth mentioning that the presidency office at HU sought to transform the campus into a smart campus. One of the predominant elements of the smart campus is to prepare online contents for the offered courses all over the faculties. This goal was monotonically achieved throughout the past five years. During the pandemic, HU electronically prepared all e-content for the offered courses to be ready and posted on Moodle. The effectiveness of the e-content of the offered courses at HU was estimated during the pandemic by measuring the quality of the e-content and assuring if it successfully meets the course learning outcomes. In our study, we compared the evaluation of the e-content from the students' and instructors' point of view. The students' evaluation for the quality of the offered e-content course was 1.98 out of 4 as a Very Low perceived factor due to the lack of proper instructional design. While the instructors' evaluations were 2.86 out of 4 as an Average perceived factor. This is inconsistent with the reported results in India (Hassan, Mirza, & Hussain, 2020), where a set of technical difficulties were occurred while creating the e-content.

Our results showed that the e-content attained the course learning outcomes with value 2.47 out of 4 as Low perceived factor from the students' perspective.

While it was 3.42 out of 4 as high perceived factor from the instructor point of view. This contradicts the fact that two-third of students did not face any problems in understanding the explained material. This is due to the fact that the previously prepared e-contents were designed to meet the blended-learning approach not a complete E-learning approach. All these results answer the first research question addressed previously in this paper.

Finally, it is a vital task to compare and investigate the E-learning education to the traditional education. A contradiction was found between the instructors' and the students' opinions. The students' evaluation was 2.08 out of 4 (Low factor), while the instructors' evaluation was 2.5 out of 4 (Average factor). The Pearson Coefficient test showed a strong positive relationship between comparing the E-learning education to the traditional education with a value 0.626 and 0.525 from students' and instructors' perspective respectively.

Self-evaluation of the E-learning experience was guided at the end of each learning unit. The students and instructors had a chance to quantify the learned material and to emerge the gained knowledge into a real-life practice. This self-evaluation allowed both instructors and students to appraise what they have taught/learned to reach a better conception of the learning subjects. Consequently, the students' evaluation for the self-evaluation was 2.30 out of 4 (Low factor) while the instructors' evaluation was 3.36 out of 4 (Average factor). Another contradiction was found in this manner which reflected the instructors'

acceptance and the students' refutation towards this type of learning. The Pearson Coefficient Test displayed a strong positive relationship between self-evaluation of the E-learning experience with a value 0.532 and 0.433 from students' and instructors' perspective respectively.

Moreover, Pearson Coefficient Test was accomplished to investigate the relationships between the set of criteria and the percentage of the quality of the E-learning evaluation. All experiments were fair, since each experiment chose one criterion out of the set of criteria shown in Table 1 as the independent variable to measure the percentage of the E-learning evaluation (dependent variable). There were statistically significant positive relationships between the predefined set of criteria and E-learning evaluation as percentage from students' and instructors' viewpoints. The values of the correlation coefficients were statistically significant at the level of significance less than (0.01) as shown in Table 1.

By comparing the students' responses with the instructors' responses on the set of the criteria, we unfortunately found that there were negative reverse relationships. The value of the statistic F-Test is either relatively low or high with statistical significance greater than 0.05. In both cases, it indicated a very weak relationship between instructors and students. This signposts a huge conflict between the students' and instructors' opinion. These results answer to the second research question addressed previously in this study.

The diversity of the students' and instructors' evaluations of the quality of E-learning process is a

<i>Factors</i>	<i>Criteria</i>	<i>Correlation Coefficient</i>	<i>Students' Perspective</i>	<i>Instructors' Perspective</i>
Technology Infrastructure	Availability of the high-speed internet	Pearson Correlation	0.423-	0.321**
		Sig. (2-tailed)	0.000	0.000
		N	16383-	382-
	Accessibility to different communication technologies	Pearson Correlation	0.489	0.362
		Sig. (2-tailed)	0.000	0.000
		N	16383	382
Virtual Classroom	Attending/running the virtual class	Pearson Correlation	0.401**	0.215**
		Sig. (2-tailed)	0.000	0.000
		N	16383	382
	Interaction between the students and their instructors	Pearson Correlation	0.409**	0.454**
		Sig. (2-tailed)	0.000	0.000
		N	16383	382
E-content	Quality of the e-content	Pearson Correlation	0.565**	0.535**
		Sig. (2-tailed)	0.000	0.000
		N	16383	382
	Full filling the course learning outcomes	Pearson Correlation	0.526**	0.431**
		Sig. (2-tailed)	0.000	0.000
		N	16383	382

Table 1 - The statistically significant relationships between the main factors and the percentage of practicing E-learning at HU. ** indicates a statistically significant p-value less than 0.01.

phenomenon that needs to be justified. The E-learning during the pandemic is considered as a successful experience from the instructors' perspective, while it is an immature experience from the students' perspective due to the following explanations:

1. Students did not understand the new role of the instructor as a guide or facilitator. Some students believed that the instructors were not teaching due to the new adapting format. Students requested instructor's emotional and intellectual support which unfortunately were not part of the E-learning process. This brings into line Hong Kong University students were also affected physically and emotionally during the pandemic, and teachers had to create an appropriate teaching and learning experience in view of the external environment and the students' internal emotional needs (Sum, 2021).
2. In Jordan, we have extremely large family size that is impossible to afford a technology device for each family member. In addition to that, all online sessions were running simultaneously from 8:00 am to 4:00 pm at school, colleges and universities. This generated a problem between the family members (UNDP, 2020).
3. Students have been raised on a face-to-face teaching approach since school time. They didn't get any chance to practice the E-learning process in any subject or part of subject before the pandemic. This drastically increased the pressure on adapting this new approach (Lemay, Bazelais, & Doleck, 2021).
4. Before the pandemic the culture of E-learning was not applied completely on any course in its correct definition because all the ready prepared e-content were used in a blended-learning approach. The methods of e-content deliverance are learning through doing, investigation, testing and evaluation. The educators became tech-savvy in the rise of the global technological teaching (Peter, 2021).
5. The learning process has two directions: one is related directly to receiving information from the instructor and the other one is related to working in groups. It is worth mentioning that the group discussion had not been activated during the virtual classes due to its large size. This consequently led to miss the cooperation between students, which decreases the quality of education (Powell & McGuigan, 2021) and (Sugino, 2021). Some instructors are running one VC for all sections of the same course. The number of students may exceed one hundred which accordingly affected the style of instructors' teaching. The spoon feeding will dominate the class, and the instructor-centered the learning approach. The instructor failed to generate a small, fixed size of students group to discuss the topic, and to work with them in solving a problem (Powell & McGuigan, 2021) and (Sugino, 2021).

5. Recommendations

There is an urgent need for HU to plan appropriate measures to protect students' and instructors' health to practice the actual definition of the E-learning in real life scenario, and simultaneously, improve the quality of the education. HU has to deploy a new tactic for education during the pandemic for the coming academic terms by disseminating the E-learning culture. Thus, a new educational era will start with a new strategy that includes students and instructors to guarantee the continuity of the education process. Some feasible suggested actions should be taken in response to the findings of our study:

1. Developing this new strategy is a tricky task due to the inapplicability of the E-learning during the pandemic. The E-learning in its current format is not accepted to be applied for the coming academic terms. The drawbacks of the E-learning experienced received from the students have to be incorporated to enhance the quality of the education and to satisfy the students' needs. Reshaping the E-learning process is a must action by establishing the virtual office hours, forcing the instructors to answer students' queries 24/7, changing the assessment plan to cover a homework per class, weekly quizzes and a well incremental structure project. Therefore, the workload for the instructors should be doubled or even tripled. Consequently, several graders have to be assigned to every instructor to support the E-learning process. The mark of the offered courses should not remain as pass/fail since this will affect the quality of the education. Therefore, a real mark has to be assigned.
2. Integrating the technology in education will increase the possibility of having sociological problems in students' life. Instructional monitoring and constant caring are highly required to reduce the complexity of using the technology among students. A policy of assigning a specific advisor for every single student is deployed to conduct a weekly meeting. This should be reflected as a part of the instructors' load.
3. No indicator when this pandemic will end, thus there is a high possibility for both instructors and students to be infected by COVID-19 during the coming semesters. Dealing with the student case is simple by extending the deadline of the submission date for quizzes or assignments and consider his/her absents as a legal excuse. On the other hand, a backup plan should be seriously adopted in the instructor case by assigning another expert instructor to cover his/her classes during the sickness period.
4. Instructors face much-challenged life started with on-line teaching and resume their research activities. One year should be added to the tenure clock due to the time they spent to be trained and

the effort they devoted to preparing the e-content. Moreover, their research activities had been suspended during this pandemic (Int@j, 2018). The Ministry of higher education in Jordan and particularly the deanship of scientific research at HU should take into consideration extending the deadline for all funded researches.

5. The higher education system must carefully look to the education in a new perspective. Providing different learning methodologies to support fairness and to guarantee the lifelong learning should be implemented in all universities. In addition, to identify new policies and regulations that support students to have a chance in choosing between the traditional learning approach and E-learning approach per course during the coming academic terms.

6. Conclusion

COVID-19 outbreak has deeply jammed the universities and schools globally and specifically in Jordan. Universities require many things to satisfy the students' needs and to reduce the instructors' concerns. In this paper, we used the statistical analysis to highlight the main factors in the E-learning process and to utilize them to improve the education process currently. Our results showed that HU has successfully integrated E-learning in the educational process. It is not only important to adapt E-learning as a response to this pandemic, but also making the higher education more reachable and available for everyone in the future. Some recommendations were highlighted in this study to help the decision makers at HU, and the other universities in Jordan, to overcome this crisis.

Acknowledgment

Authors would like to thank Prof. Husam Aldeen Al-Khadash – Vice President at Hashemite University for facilitating accessing the collected data.

References

- Agarwal, S., & Kaushik, J. (2020). Student's Perception of Online Learning during COVID Pandemic. *The Indian Journal of Pediatrics*, 87(554).
- Al-Shboul, M., Rababah, O., Al-Saideh, M., Betawi, I., & Jabbar, S. (2013). A Vision to Improve E-Learning at The University of Jordan. *World Applied Sciences Journal*, 21(6), 902-914.
- Alkhwaja, M. I., & Halim, M. B. (2019). Challenges of E-Learning System Adoption in Jordan Higher Education. *International Journal of Academic Research in Business and Social Sciences*, 9(9), 487-494.
- Almarabeh, T., & Mohammad, H. (2013). E-learning in the Jordanian Higher Education System: Strengths, Weakness, Opportunities, and Threats. *Journal of American Science*, 9(3), 281-287.
- Berezhna, S., & Prokopenko, I. (2020). Higher Education Institutions in Ukraine during the Coronavirus, or COVID-19, Outbreak: New Challenges vs New Opportunities. *12(1)*, 130-135.
- Buttar, S. S. (2016). ICT in Higher Education. *PEOPLE: International Journal of Social Sciences*, 2(1), 1686-1696.
- Daniel, S. J. (2020). Education and the COVID-19 pandemic. *Prospects*.
- Fayyumi, E., Idwan, S., AL-Sarayreh, K., & Obeidallah, R. (2015). E-learning: challenges and ambitions at Hashemite University. *International Journal of Innovation and Learning*, 17(4), 470-485.
- Ferri, F., Grifoni, P., & Guzzo, T. (2020). Online Learning and Emergency Remote Teaching. *Societies*, 10:86.
- Hassan, M., Mirza, T., & Hussain, D. (2020). A Critical Review by Teachers on the Online Teaching-Learning during the COVID-19. *International Journal of Education and Management Engineering(IJEME)*, 5, 17-27.
- Int@j. (2018). *JORDAN ICT & ITES SECTOR STATISTICS 2018*. Jordan: Information and Communications Technology Association in Jordan- int@j.
- Lemay, D., Bazalais, P., & Doleck, T. (2021). Transition to online learning during the COVID-19 pandemic. *Computers in Human Behavior Reports*, 4:100130.
- Levine, A., & Sun, J. (2002). *Barriers to Distance Education*. Washington, DC: American Council on Education.
- Mahalakshmi, K., & Radha, R. (2020). COVID 19: A MASSIVE EXPOSURE TOWARDS WEB BASED LEARNING. *Journal of Xidian University*, 14(4), 2405-2411.
- Mahyoob, M. (2020). Challenges of e-Learning during the COVID-19 Pandemic Experienced by EFL Learners. *Arab World English Journal (AWEJ)*, 11(4), 351-362.
- Marinoni, G., Land, H., & Jensen, T. (2020). *THE IMPACT OF COVID-19 ON HIGHER EDUCATION AROUND THE WORLD IAU Global*

- Survey Report*. International Association of Universities.
- MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC. (2009). *National eLearning Strategy for Higher Education (2007-2010)*. Jordan.
- Nenko, Y., Kybalna, N., & Snisarenko, Y. (2020). The COVID-19 Distance Learning: Insight from Ukrainian students. *The Brazilian Scientific Journal of Rural Education*, 5, 1-19.
- Peter, R. (2021). Necessity of e-Content and Digital Education in ELT During Covid-19 Pandemic Situation. *Journal of Linguistics and English Language Teaching*, 1(1).
- Powell, L., & McGuigan, N. (2021). Teaching, virtually: a critical reflection. *Accounting Research Journal*, 34(3).
- Pujari, V., Sharma, Y. K., & Jathar, M. (2020). Role of ICT in Higher Education. *International Journal of Advance and Innovative Research*, 7(1), 117-119.
- Raheem, B. R., & Khan, M. (2020). The role of e-learning in covid-19 crisis. *International Journal of Creative Research Thoughts (IJCRT)*, 8(3), 3135-3138.
- Sahu, P. (2020). Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff. *Cureus*, 12(4).
- Sathishkumar, V., Mahalakshmi, K., Kumar, D., & Saravanakumar, D. (2020). E-Learning during Lockdown of Covid-19 Pandemic: A Global Perspective. *International Journal of Control and Automation*, 13(4), 1088-1099.
- Sugino, C. (2021). Student Perceptions of a Synchronous Online Cooperative Learning Course in a Japanese Women's University during the COVID-19 Pandemic. *Education Sciences 2021*, 11(5:231).
- Sum, A. (2021). ((E-)Learning to Understand and Love Yourself: An Attempt to Teach Healthy Lifestyle in the Midst of Social Unrest. *Frontiers in Education*, 6:624370.
- Turnbull, D., Chugh, R., & Luck, J. (2019). Learning Management Systems: An Overview. In *Encyclopedia of Education and Information Technologies* (pp. 1-7). Switzerland: Springer Nature.
- UNDP, U. (2020). *COVID-19 Impact on Households in Jordan: A Rapid Assessment*.
- Wargo, E. (2020). Intertwined higher education places and spaces. *Journal for the Study of Postsecondary and Tertiary Education*, 5, 079-084.
- Wilp, T. (2020). Learning, Teaching and First Aid in times of COVID-19. *International Journal of First Aid Education*, 3(1).

The impact of online instruction integrated with brain-based teaching approach to EFL students with different motivation level

Rukminingsih^{a,1}, Januarius Mujiyanto^a, Joko Nurkamto^b, Rudi Hartono^a

^aState University of Semarang – Semarang (Indonesia)

^bUniversity of Sebelas Maret – Solo (Indonesia)

(submitted: 12/8/2020; accepted: 8/12/2021; published: 20/12/2021)

Abstract

In the Covid 19 pandemic, teachers and students have to implement the distance education by using online learning. It creates new obstacles for them but also stimulates potential methods for teaching and learning process to meet the digital era. This study investigated the difference effect of implementing online instruction integrated with brain-based teaching (BBT) approach as an experimental group. A quantitative research design with factorial 2 x2 was applied, then two classes involving each 33 students for experimental group and 30 students for a control group of a private college in Indonesia were chosen as the sample. The instruments used were a questionnaire and a test. Two-way ANOVA was applied to analyze the data. The findings showed that (1) There was distinct impact between experimental class and control class in students' reading achievement, (2) The achievements of the students in the Reading course with high motivation were higher than those with low motivation., (3) There was an interaction between teaching strategies and the level of students' motivation in EFL reading achievement. These findings also can stimulate teachers to teach brain-based teaching approach with online instruction to students to enhance their motivation in reading. have to integrate BBT with technology support for the meaningful learning Further research and development on different brain-based teaching approaches is suggested. These findings can encourage teachers to teach EFL learners in brain-based approach integrated with online instruction with the purpose of improving their motivation for reading.

KEYWORDS: Brain- based Teaching Approach, Online instruction, students' Reading Achievement, Reading motivation level.

DOI

<https://doi.org/10.20368/1971-8829/1135339>

CITE AS

Rukminingsih, Mujiyanto, J., Nurkamto, J., Hartono, R. (2021). The impact of online instruction integrated with brain-based teaching approach to EFL students with different motivation level. *Journal of e-Learning and Knowledge Society*, 17(2), 66-73. <https://doi.org/10.20368/1971-8829/1135339>

1. Introduction

Nowadays coronavirus pandemic has affected educational systems worldwide, leading to the

widespread closures of schools and universities. Efforts to stop the spread of COVID-19 through non-pharmaceutical interventions and preventive measures such as social distancing and self-isolation have prompted the widespread closure of primary, secondary, and tertiary schooling in over 100 countries. Teachers have changed their teaching method by using full online. On 1 April 2020, the number of confirmed COVID-19 cases in Indonesia has reached more than 1.500 cases (WHO, 2020). The National Disaster Management Authority of Republic of Indonesia has decided to extend the period of disaster emergency caused by COVID-19 pandemic until 29 May 2020 (BNPB, 2020). The global spread of COVID-19 pandemic causes class suspensions resulting in the need for online learning (Moorhouse, 2020).

¹ corresponding author - email: rukminingsih19@yahoo.co.id

Since 17 March 2020, the Indonesian Minister of Education and Culture has instructed schools to undertake online education in COVID-19 affected areas (Mendikbud, 2020b). Shortly after that, because of the increasing spread of COVID-19 and the preservation of students, teachers and all educational staff health (Mendikbud, 2020a), the Minister of Education and Culture of the Republic of Indonesia ordered all schools to run online studies from 24 March 2020. These policies lead students to learn from home and teachers to work from home, too. It fully replaces face-to-face learning in a classroom setting with online learning which possibly lasts till the end of the semester due to the COVID-19 pandemic. It becomes a new challenge for both students and educators to run online learning. According to Cao et al., (2020), these actions certainly give an impact on education, particularly students' growth.

In pandemic Covid 19 era, all higher education students are learning fully online. However, educators still have to know how learning can be maximized by considering the students' brains learn in online learning. Brain-based teaching can be implemented by integrating ICT tools which are the gateway of ease learning. Making learning is meaningful. Learning is the main goal of the brain-based teaching approach. Brain-based teaching is meaningful involving a motivating, positive way of maximizing teaching and learning (Raghavendran & Begum, 2019). Some strategies of brain-based approach with online instructions were implemented in this research such as activating students' engagement in the online class, increasing multi-modal sensory learning, using online brain break, implementing synchronous and asynchronous learning, beginning with what the learners already know and use stories and metaphors to help learners make brains' connection.

Teaching English as a foreign language is a challenging. As English foreign language educators, they must learn to constantly adapt to their students' brains work. One of the language skills is reading. In EFL reading classroom, educators may work harder to find out what teaching techniques can stimulate students' motivation in reading class. According to Ghaith (2003), teaching strategies can also enhance students' engagement or involvement in the learning process. Reading has become an important skill in EFL teaching and learning process.

Understanding reading is an activity designed to understand the messages of a specific text (Williams, 1998). Learning as a foreign language in Indonesia (EFL reading) can usually be included in the reading understanding lessons. It aims to improve students' skills in understanding the meaning of a written text by using English as a foreign language. However, it is considered more difficult to read foreign language materials than first language material most often. They found it difficult and boring to read English texts. It makes them less motivated, especially in reading, to learn English. Tahir (2012) has been supporting that that most of the

students have low vocabulary mastery which hindered them to read the English text. In fact that students may feel bored when they get reading class. Moreover, some educators may just instruct the students to read the text without knowing whether the students are ready with the educators' instruction.

To accommodate educators' expectations for the teaching and learning process successful needs to consider how the students' brains work and learn. The human brain has the largest area of cortex that is not designated for a specific function (Jensen, 1998). How the brain learns foreign languages should be considered by educators. According to Conboy (2013), in stimulating foreign language learners, a greater understanding of the brain's language acquisition of a second language on brain function supports and informs the best practices in education. Weber et al. (2015) stated that learning a new language is a difficult task. It requires skills for memorizing new words, grammatical aspects, and linguistic knowledge. That is why an understanding of how the brain receives and saves information will help educators to make informed choices for effective teaching models (Srikoon et al., 2017). A brain-based can positively impact students' motivation, attitudes, and academic achievement. Much of the research is situated in a quantitative paradigm designed to measure motivation, attitudes toward learning, and academic achievement.

Studies on brain-based teaching have been recently conducted by some scholars however, there have been few studies on brain-based teaching integrated with online instruction. Some researchers commonly focus on the implementation of brain-based teaching and brain-based learning in the classroom which doesn't implement in virtual classes (Srikoon et al., 2017; Raghavendran & Begum, 2019; Weber et al., 2015; Schwartz, 2015; Gozuyesil, 2014). Thus, this study is to fill the gaps from previous studies by combining brain-based teaching with online instruction. It also shows that online instruction brings different qualities depending on the motivation of the students, which is to be considered for the use of technology.

2. Related Works

2.1 Brain - Based Teaching Approach

The brain-based teaching approach is an example of the student-centered approach. In a brain-based approach, a teacher facilitates a learning process that also creates a positive learning environment and students' engagement in the class. The purposes of this approach create students' attention, understanding, and long-term memory toward their lessons. It is based on the principles of brain-based learning developed by (Caine & Caine, 1991 and 2003; Sausa, 1995). They stated that brain-based learning involves the engagement of emotions, positive learning environments, music,

movement, meaning-making, and no threatening for maximum learner participation and achievement. Instructional technique, relaxed alertness, orchestra immersion, and active procession are the main principles of brain-based learning.

Brain-based learning may also influence the development of social-emotional students development to understand and regular emotions while they are learning. Studies have found that brain-based learning strategies can enhance students' motivation and achievement in the learning process (Sani, et al., 2018; Jamdar & dasila, 2020; Mekarina & Ningsih, 2017) intrinsic motivation can be enhanced when students have an intrinsic love of learning with the right mindset. Some studies about brain-based learning have been conducted since 1990. The findings confirmed how the brain works and learns. Caine & Caine (1994) and argue that the human brain is unique and it can do multiple complex and concrete experiences which are important for the learning and teaching process. Harvard established an initiative called Mind, Brain, and Behavior to focus on the influence of research emerging from neuro and cognitive science (Schwartz, 2015). Uzezi & Jonah (2017) stated that the brain-based teaching approach creates progress on students' achievement, motivation, and long-term memory.

2.2. Reading Comprehension in EFL Setting

Reading has become an important skill in the EFL teaching and learning process. Reading comprehension is an activity aimed to understand the messages of a particular text (Williams, 1998). The teaching of reading like a foreign language (EFL reading) in Indonesia can be generally included in the teaching of reading comprehension.

Kweldju (2000) stated that even though reading is one of the important language skills, many students become reluctant EFL readers. Moreover, EFL reading is found that many students consider reading as uninteresting activity (Kweldju, 1996; Rukmini, 2004). Kweldju (1996) found that students were not interested in reading their content area textbooks although they thought such textbooks were useful. She stated that reasons behind this lack of interest included students' limited background knowledge, inability to understand the content of the text, and complicated organizational structure of the text. Successful comprehension requires coordination of skills at many levels to extract and construct meaning. The complexity of the language used was determined by the level of difficulty comprehension of a certain content of the text (Qarqes & Rashid, 2017). There are so many differences between the native language students use in everyday conversations and English as a foreign language in Indonesia.

Kweldju (2000) stated that even though reading is one of the important language skills, many students become reluctant EFL readers. Moreover, EFL reading is found that many students consider reading as uninteresting

activity (Kweldju, 1996; Rukmini, 2004). Kweldju (1996) found that students were not interested in reading their content area textbooks although they thought such textbooks were useful. She stated that reasons behind this lack of interest included students' limited background knowledge, inability to understand the content of the text, and complicated organizational structure of the text. Successful comprehension requires coordination of skills at many levels to extract and construct meaning. The complexity of the language used was determined by the level of difficulty comprehension of a certain content of the text (Qarqes & Rashid, 2017). There are so many differences between the native language students use in everyday conversations and English as a foreign language in Indonesia.

2.2 Reading Motivation

The differences between spelling and pronunciation between L1 (2017) and target language that affect students' low motivation have been identified by Tahir and Hanapi (2007). It was also supported by Salikin & Tahir, (2017) that the students get bored and low motivated to comprehend the text since they often misunderstand of English text they read and are confused to answer the question of English text. Admuson (2015), Castle (2015) and Anne (2014) state that motivation is very essential to encourage the language learning process. Reading motivation stimulates students to be involved in reading and improves students' reading skills to achieve reading comprehension.

Komiyama (2013) reports that engagement is the pleasure of reading interesting topics in books, papers, and websites. The level of engagement and participation in reading can also be defined (Wang & Guthrie, as cited in McGeown, 2013). Komiyama (2013) defines curiosity as a wish to learn a very interesting subject. The preference for the challenge is the last factor in inherent motivation. The wish to work with or control complex reading materials is defined (Wang & Guthrie as cited in McGeown, 2013). Intrinsic motivation is an activity because it offers satisfaction, pleasure, and even interest.

Intrinsic motivation as stated by Deci & Ryan (2000) can cause someone to do an activity because it is interesting. It means that someone who is motivated intrinsically tends to do an activity for pleasure only. In this study, we used the motivation for the reading questionnaire (MRQ) adapted from Wingfield, et al., (1996) to assess students' reading motivation levels involving high and low. A motivation reading questionnaire is used to know students' alteration in reading activities. It also can be used to generate students' descriptions of reading motivation. Komiyama (2013) says that the satisfaction gained through mastering or assimilating complex ideas in the text is the priority for the challenge. Learners are motivated if they end up reading such hard material or text by this factor.

2.4. Online Instruction Integrated with Brain Based Teaching in EFL Reading Comprehension Course

Brain-based learning (BBL) is a teaching approach that combines cognitive neuroscience and education. Some studies have suggested teachers implement it in the classroom. BBL strategy is employing a brain-based strategy in the classroom. Gozuyesil (2014) found that a brain-based approach is powerful for a successful teaching process. The models of teaching and learning associated with brain-based teaching are brain-based learning (BBL) which was developed by Eric Jensen and whole brain-based teaching developed by Chris Biffle (2013). The whole brain-based teaching model is dealing with the brain system as the foundation in designing a learning model which employs an instructional approach based on the left and the right hemisphere (Biffle, 2013).

There are three main approaches to brain-based learning: 1) creating a positive classroom atmosphere that can stimulate students' ability to think; 2) bringing students to a comfortable environment when they are learning; 3) creating meaningful learning activities. When teachers implement the BBL approach, there are three ways: (1) creating a classroom atmosphere that is capable of stimulating the student's ability to think; (2) bringing students into an environment that are pleasant enough; (3) creating an atmosphere of active and meaningful for students. Based on this theory, students should be provided a learning environment that is safe and free from threats. Handayani & Corabima (2017) confirmed that students learn the meaning and content of the brain to prepare students to store, process, and retrieve information in a fun way.

Jensen (2008) stated that understanding brain-based education is needed by all educators. If they neglect it, it would cause failure in the learning process. Brain-based teaching, on the other hand, examines how instruction and pedagogy may provide a foundation for facilitating learning when aligned with best practices for brain engagement. Hardiman (2012 b) states that teaching to the brain also termed brain-based teaching brain targeted teaching focuses on the transformation of pedagogy influenced by knowledge of how the brain learns best.

Brain-based teaching with technology integration enhances a positive learning environment. Duman (2010) said that using technology such as online instruction in teaching enhances the quality of a good learning environment such as emotional safety, novelty, repetition, problem-solving having time to learn and pursuit of a learning goal is catered by online instruction. In this research, the researchers employ Google classroom and zooming as online platforms in reading classes. Google Classroom is an online learning management tool that helps change the classroom set-up from being teacher-centered to learner-centered learning. It also enables students the opportunity to open inquiry, dialogue, and creative thinking as active participants in the class. Shaharane (2016) found that using Google Classroom as a blended learning tool is perceived to be useful in helping

the learning process of students. Using zooming can create students' engagements and positive atmosphere in online learning.

3. Methods

Design: This research was carried out in a private college in Indonesia, STKIP PGRI Jombang, by using factorial design 2×2 to compare two teaching strategies (such as online instruction based on brain-based teaching and online instruction integrated with flipped classroom and two types of students' motivation (high and low). In addition, there were three variables in this research, namely two independent variables (online instruction based on brain-based teaching and online instruction integrated with flipped classroom strategies), and the moderator variable was students' motivation, and one dependent variable is called reading comprehension. The research design was presented in Table 1. In doing the research internal and external validity were controlled as well as possible.

Teaching Strategy (A)	Online Instruction integrated with Brain Based Teaching (A1)	Online instruction integrated with flipped classroom (A2)
Students' Motivation (B)	As an experimental class	As a control group
High (B1)	A1 B1	A2B1
Low (B2)	A1 B2	A2 B2

Table 1 - Factorial research design 2x2.

A1 B1: Students who have high motivation are taught by using online instruction based on brain-based teaching approach.

A2B1: Students who have high motivation are taught by using online instruction integrated with flipped classroom.

A1 B2: Students who have low motivation are taught by using online instruction based on brain-based teaching.

A2 B2: Students who have low motivation are taught by using online instruction integrated with flipped classroom.

Participants: The location of this research was held in one of the private colleges in Jombang East Java, Indonesia. This college now implemented distance education by employing full online learning. The population of the research was the fourth semester of English Department students in STKIP PGRI Jombang who were taking Critical Reading class. The samples were semester of English Department students in STKIP PGRI Jombang who were taking Critical Reading class from two different classes. The samples were around 21 years old, The sampling technique was Cluster Random

in class. Fraenkel, Wallen, and Hyun (2012) stated that cluster random sampling is obtained by using groups as the sampling unit rather than an individual. Two classes involving 33 students for the experimental group and 30 students for the control group in the fourth grade were chosen as the sample.

Instruments: There are two kinds of instruments used in this study. They are motivation reading questionnaires and reading comprehension tests. The questionnaire was used to measure students' reading motivation levels to classify students into high and low levels of reading motivation. The questionnaire with Likert scale in which the questionnaire was designed with related indicators of students' reading motivation. A reading comprehension test was used to assess students' achievement in EFL reading comprehension. The questionnaire, which was constructed with A lot like me (4), A little like me (3), A little different from me (2), and Very different from me (1) adapted from Wigfield and Guthrie (1997) and Komiyama (2013). The dimension involves both intrinsic and extrinsic motivation.

4. Results

The data analysis used in this study was a two-way Analysis of Variance (ANOVA) at the significance level $\alpha = 0.05$. The three hypotheses were tested. There were two requirements before applying the two-way ANOVA, namely normality and homogeneity. The normality test used the Lilliefors test which can be seen in Table 2. The homogeneity of variants was measured by Levene's test can be seen in Table 3.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for achievement	.093	63	.200*	.983	63	.535

Table 2 - Tests of normality.

a. Lilliefors Significance Correction

Based on the result of the normality test in Table 2, the significance of the standardized residual for students' reading achievement is 0.535 and it is higher than 0.05 Alpha. It means that the data is normal.

Dependent Variable: Reading Achievement

F	df1	df2	Sig.
2.569	3	59	.063

Table 3 - Levene's test of equality of error variances.

a. Lilliefors Significance Correction

Based on the result of the no test in Table 2, the significance of equality of error variances for

achievement is 0.63 and it is higher than 0.05 Alpha. It means that homogeneity of variants was reached.

Dependent Variable: Reading Achievement

Teaching strategies	Motivation level	Mean	Std. Dev	N
online instruction with BBT	high motivation	79.88	2.497	17
	low motivation	78.13	2.579	16
	Total	79.03	2.651	33
online instruction with flipped classroom	high motivation	78.27	4.590	15
	low motivation	71.40	4.188	15
	Total	74.83	5.553	30
Total	high motivation	79.13	3.661	32
	low motivation	74.87	4.815	31
	Total	77.03	4.745	63

Table 4 - Descriptive statistics.

Table 4 displays the means score from students' reading scores based on teaching strategies and reading motivation levels. It can be seen that the students' means score who are taught by online instruction with BBT strategy with the high reading motivation levels is higher than students with low motivation levels. Then it also can be seen that the students' means score who are taught by online instruction with flipped classroom strategy with the high reading motivation levels higher than students with low motivation level. However, the table shows that the total mean score between online instruction with BBT strategy is higher than online instruction with flipped classroom strategy as a control group. A flipped classroom is a sort of blended learning that is implemented online at home or outside of the classroom (Yang et. al., 2019).

The following is the summary of the two -way ANOVA computation which contains the variance related to the score of means, teaching strategies, students' motivation, interaction, error, and means of treatment. By looking at this description of the analysis of variance, it is easier to take into account the analysis related to two-way ANOVA as shown in the Table 5.

This summary of the computation result of the two-way ANOVA could be used to verify or to describe testing hypotheses. By considering the idea of the above table, it could be related to the testing of hypotheses. Based on these testing hypotheses, it could be concluded that hypotheses were verified. To decide whether the alternative hypothesis is accepted or rejected from the result of tests of between-subject effects. The significance of teaching strategies is 0.000 which is 0.000 is lower than 0.05 so there are different scores based on factor variables. The significance of the reading motivation level is 0.000 which is 0.000 is lower than 0.05 so there are different scores based on factor variables. The interaction between teaching strategies and motivation toward students' reading score is at 0.006 which is lower than 0.05. It can be concluded that the

three hypotheses are verified at alpha 0.05, as seen in the following.

- 1) The students' achievement in Reading Comprehension taught by using online instruction based on brain-based teaching strategy is higher than those taught by using online instruction integrated with flipped classroom strategy is true,
- 2) The students' achievement in Reading Comprehension with high motivation gets higher than those low motivation is true,
- 3) There is an interaction between teaching strategy and students' motivation level in reading comprehension is true.

Dependent Variable: Reading Achievement

Source	Type III Sum of Squares	df	Mean Square	F
Corrected Model	655.888 ^a	3	218.629	17.430
Intercept	371728.848	1	371728.848	29635.917
Strategies	273.180	1	273.180	21.779
Motivation	292.055	1	292.055	23.284
Strategies * motivation	102.511	1	102.511	8.173
Error	740.048	59	12.543	
Total	375231.000	63		
Corrected Total	1395.937	62		

Table 5 - Tests of between-subjects effects.
R Squared = .470 (Adjusted R Squared = .443)

Dependent Variable: Reading Achievement

Motivation level	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
high motivation	79.075	.627	77.819	80.330
low motivation	74.763	.636	73.489	76.036

Table 6 - Motivation level.

Dependent Variable: Reading Achievement

Teaching strategies	Motivation level	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
online instruction with BBT	high motivation	79.882	.859	78.164	81.601
	low motivation	78.125	.885	76.353	79.897
online instruction with flipped classroom	high motivation	78.267	.914	76.437	80.096
	low motivation	71.400	.914	69.570	73.230

Table 7 - Teaching Strategies * motivation level.

5. Discussion

Based on Tables 5, 6, and 7, it can be concluded that students' achievement in Reading Comprehension by employing online instruction based on brain-based teaching there is a great increase in conceptual understanding after the implementation of online instruction based on brain-based teaching in Reading comprehension class. Pourhosein (2014) "maintained that using technology can create a learning atmosphere centered around the learner rather than the teacher that in turn creates positive changes". Sabitzer, (2012) stated that technology contributes to integrating brain-based learning principles because it can also support the learning success of other subjects. The principles of brain-based teaching related to the implementation of technology are (1) individual differences in maturation, development, and prior learning are taken into consideration, and (2) the environment is supportive, empowering, and challenging (Caine, 2012).

By employing online instruction, such as in Google classroom, teachers can use feedback loops to find out whether the students' perception matches their expectations. This step is used to organize information in the brain at different levels. Students must transform information as to their learning with the use of working memory and prior knowledge to form long-term allow students to use that information into different products that can become a trigger for conceptual understanding. Laurence & Maricar (2020) and Rukminingsih (2018) found that teachers should make use of brain-based teaching strategy and the concept of brain-based learning in the classroom with online instruction.

The result of the two ways ANOVA calculation shows that motivation significantly affects students' achievement in reading comprehension. The total mean indicated that the students' achievement with high motivation is higher than students who have low motivation. The total mean indicated that the students with high motivation get higher achievement than the students with low motivation. It is because the students with high motivation tend to be more active in learning, more enthusiastic with the tasks given by the teacher, and never feel bored to retry in their attempt to achieve the maximal result in reading comprehension.

On the other hand, the students with low motivation attempt less than the students with high motivation. They involve less in the learning process, do not like challenging actions and teaching-learning process that needs much-thinking action. They do less attempt in achieving the maximal result in learning reading comprehension. This condition can be observed directly during the teaching-learning process. As a matter of result of their motivation, they get lower achievement in reading comprehension than those who have high motivation. The group of students with high motivation has higher achievement than the group of students with low motivation. The students with high motivation get a

higher result in reading comprehension than the students with low motivation. Thus, it is clear that different levels of students' motivation affect the students' abilities in reading comprehension. This exploratory analysis shows that the brain-based learning Approach has improved the Science attitude and motivation of learners once appropriately implemented is encouraging teaching strategy (Akyurek, 2013; Admuson, 2015; Castle, 2015 & Anne, 2014). Reading motivation encourages students to engage in reading and improves students' reading skills to improve students' reading comprehension.

The finding of two ways ANOVA calculation indicated that there is a significant interaction between teaching strategies and motivation. Teaching strategy and motivation are two of several important factors that influence learning achievement. Thus the interaction was computed to find out the better achievement in reading comprehension among the cells. It indicates that the students were taught by online instruction integrated with brain-based teaching strategy with high motivation and the students that were taught by employing online instruction integrated with brain-based teaching strategy with low motivation have the most significant difference among others. The students that were taught by employing online instruction integrated with brain-based teaching strategy with high curiosity have higher achievement in reading comprehension than the students that were taught by employing strategy with high motivation. On the other hand, the students with low motivation get higher students' achievement in reading comprehension if they were taught by using online instruction integrated with flipped classroom strategy than they were taught by using online instruction integrated brain-based teaching strategy.

The interaction could be continued to the use Tuckey test to verify the interaction itself. The Tuckey test described and showed that students' lower motivation is matching to the use of online instruction integrated with flipped classroom and students' higher motivation is also matching to the use of online instruction integrated with a brain-based teaching strategy in teaching reading comprehension.

6. Conclusion

Based on these findings, we have concluded that online instruction brain-based teaching had a statistically significant influence on the students' motivation. Therefore, it proves that brain-based learning activities improve students' motivation. The Covid 19 Pandemic has influenced many things in the world especially the system of education. Schools employ distance education via online learning. It also occurs in Indonesia which should employ full online. The advancements in technology have triggered the expectations of the present generation learners as digital technology and

ICT have created a great impact among the users. In such a scenario and also to face these challenges, teachers should ensure that the contents shared inside and outside the classrooms lead to a meaningful, productive learning environment. Rukminingsih (2021), and Retone & Maricar, (2020) state that technologies may contribute to integrating brain-based teaching principles because technology may support students comfortable learning environment and motivate to have various sources of their knowledge,

The finding of this study confirms that online instruction with brain-based teaching is meaningful involving a motivating, positive way of maximizing teaching and learning (Caine and Caine, 1994; Raghavendran & Begum, 2019). Schwartz (2015) and Uzezi & Jonah (2017) also find that the brain-based teaching approach creates progress on students' achievement, motivation, and long-term memory Therefore it is suggested that educators need to know how the students' brains work by online instruction to meet the technology era. The virtual learning environment has transcended time and space of the present age learner as it creates a new world of learning that triggers the interest and creativity of every learner who experiences it.

References

- Akyürek, E.(2013). Effects of brain-based learning approach on students' motivation and attitudes levels in science class. *Mevlana International Journal of Education (MIJE)*, 3(1), 104-119.
- Biffle C. (2013). Whole brain teaching.(serial online). <http://www.wholebrainteaching.com>.
- Caine, R. N., & Caine, G. (1990) . Understanding a brain based approach to learning and teaching. Retrieved September 14, 2019, from <http://poncelet.math.nthu.edu.tw/chuan/note/note/brain-based>
- Caine, R.N., & Caine, G.(2012) brain/mind learning principles in action. Retrieved from: <http://education.jhu.edu>
- Conboy, B. (2013). Neuroscience Research: How Experience with One or More Languages Affects the Developing Brain. California's Best Practices for Young Dual Language Learners: Research Overview Papers. California Department of Education (CDE) State Advisory Council on Early Learning and Care. Sacramento, CA 95814.
- Duman, B. (2010). The Effects of Brain-Based Learning on the Academic Achievement of Students with Different Learning Styles. In Kuram ve Uygulamada Eğitim Bilimleri / Educational Sciences: Theory & Practice (4th ed., Vol. 10).

- Eğitim Danışmanlığı ve Araştırmaları İletişim Hizmetler Tic. Ltd. Şti
- Fraenkel, J. E., Wallen, N. E., & Hyun, H. H. (2012). *How To Design and Evaluate Research In Education*. New York: Mc Graw Hill.
- Hardiman, M. (2012). *The Brain-Targeted Teaching Model for 21st-century schools*. (pp. 27-29). Corwin Publishing.
- Handayani, S.B., & Corebimas, A.D.(2017). Model brain based learning (BBL) and whole brain based teaching (WBT) in learning. *International Journal of Science and Applied Science*, 1(2),153-161
- Hardiman, M., Delgado, S., Grizzard, C. O., Novak, S., Stella, J., & Gentry, K. (2012). *The Brain-Targeted Teaching Model for 21st century schools: Reading companion and studyguide*. (89-90). Corwin Press. <http://www.braintargetedteaching.org/Media/ReadingCompanionandStudyGuideBTTfor2>
- Jamdar, M., & Dasila, P. A conceptual research study on impact of traditional v/s brain based learning approach on knowledge, clinical performance, motivation and self-esteem. *European Journal of Molecular & Clinical Medicine*, 7(10).
- Moorhouse, B. L. (2020). Adaptations to a face-to-face initial teacher education course ‘forced’ online due to the COVID-19 pandemic. *Journal of Education for Teaching*. <https://doi.org/10.1080/02607476.2020.1755205>
- Mekarina, M., & Ningsih, Y. P. (2017). The effects of brain based learning approach on motivation and students achievement in Mathematics Learning. *Journal of Physics: Conference Series*, 895(1). <https://doi.org/10.1088/1742-6596/895/1/012057>
- Pourhossein G. A. (2014). A detailed analysis over some important issues towards using computer technology into the EFL classrooms. *Universal Journal of Educational Research*, 2(2), 146-153. doi:10.13189/ujer.2014.020206
- Qarqez, M., & Rashid, R.A.(2017). Reading comprehension difficulties among EFL learners: The case of first and second year students at Yarmouk University in Jordan. *Arab World English Journal*, 8(3). DOI: <https://dx.doi.org/10.24093/awej/vol8no3.27>.
- Retone L. R & Maricar, P.(2020). Effects of Technology-Integrated Brain-Friendly Teaching on Retention and Understanding in Photosynthesis and Cellular Respiration. IC4E 2020, January 10–12, 2020, Osaka, Japan. DOI: <https://doi.org/10.1145/3377571.3377590>
- Rukminingsih.(2018, October 13-15). Integrating neurodidactics stimulation into blended learning in accommodating students English l. earning In EFL Setting[Paper presentation].13th Annual Asian Conference Education, Tokyo, IAFOR, Japan.
- Rukminingsih, Mujiyanto, J., Nurkamto, J. & Hartono, R.(2021).Building Executive Function With Technology Support: Brain Based Teaching Strategies.UK. Taylor & Francis Group. <https://doi.org/10.1201/9781003199267-18>
- Sprenger, M. 2005. *How to Teach So Students Remember*, 2nd Edition. Alexandria,, Virginia,: ASCD.
- Shaharane, I. N. M., Jamil, J. M., & Rodzi, S. S. M. (2016). Google classroom as a tool for active learning. doi: 10.1063/1.4960909
- Sabitzer, B. (2011).Neurodidactics: Brain-based ideas for ICT and Computer Science Education, *The International Journal of Learning*, 18(2), 167-175.
- Srikoon, S., Bunterm, T., Nethanomsak, T., & Ngang, T.,K.(2017). A comparative study of the effects of the neurocognitive-based model and the conventional model on learner attention, working memory and mood. *Malaysian Journal of Learning and Instruction*, 14(1).83-110.
- Sousa, D. A. (2001). *How the brain learns: A classroom teacher’s guide*. California, Corwin Press,Inc.
- Sani, A., Rochintintawati, D., & Winarno, N.(2019). Enhancing students' motivation through brain-based learning. *International Conference on Mathematics and Science Education (ICMScE 2018) IOP Conf. Series: Journal of Physics: Conf. Series* 1157 (2019) 022059 IOP Publishing <https://doi.org/10.1088/1742-6596/1157/2/022059>
- Uzezi, J. G., & Jonah, K. J. (2017). Effectiveness of brain-based learning strategy on students’ academic achievement, attitude, motivation and knowledge retention in electrochemistry. *Journal of Education, Society and Behavioural Science*, 21(3), 1–13. <https://doi.org/10.9734/JESBS/2017/34266>
- Yang, S-C ,Liu -T , & Todd G.(2019). The effect of flipped classroom on high and low achieves’ English vocabulary learning. *The Journal of Asia Tefl*, 16(4), 1251-1267. <http://dx.doi.org/10.18823/asiatefl.2019.16.4.12.1251>

The Influence of the Student Team Achievement Division Model on Communication Skills in Economics Subjects

Nazaruddin Ali Basyah^{a, 1}, Marzudi Md Yunus^b, Irham Fahmi^a,
Zakaria A. Jalil^a, Zulfadhli Rusli^a

^aUniversitas Syiah Kuala-Banda Aceh (Indonesia)

^bUniversity of Malaya-Kuala Lumpur (Malaysia)

(submitted: 29/11/2020; accepted: 15/12/2021; published: 22/12/2021)

Abstract

This study reviewed the effects of the Student Team Achievement Divisions (STAD) cooperative learning strategies model compared to the traditional method of communication skills in economic subjects among secondary school students in Aceh. The study aims to identify the relationship between attitude change and communication skills that are influenced by family income. Besides, this research also investigates the relationship between communication skills with student achievement in the economic subject. The quasi-experimental designs with a pre-test and post-test used to collect data in this study. After fourteen weeks of treatment for the experimental group, both groups performed the Post-Test. The findings of the T-test showed a significant difference in student communication skills in economic subjects between the experimental group and the control group. The method of data analysis used analysis of variance (ANOVA) showed performance was higher on the post-test experimental group compared to the control group. This finding indicates that the use of the STAD cooperative learning strategies model during the review period can increase student achievement in the economic subject. The implications of this study show that the STAD Cooperative Learning model can be a model for teaching and learning in economics to improve communication skills among students in Aceh.

KEYWORDS: Cooperative Learning, STAD, Communication Skills, Academic Achievement, Economic Subjects.

DOI

<https://doi.org/10.20368/1971-8829/1135407>

CITE AS

Basyah, N.A., Yunus, M.M., Fahmi, I., Jalil, Z.A., & Rusli, Z. (2021). The Influence of the Student Team Achievement Division Model on Communication Skills in Economics Subjects. *Journal of e-Learning and Knowledge Society*, 17(2), 74-84. <https://doi.org/10.20368/1971-8829/1135407>

1. Introduction

Communication skills are not required to add in training programs for professionals, but it needs to be in the school curriculum. Educator competence is considered the link between communication skills and student interaction. Positive students assess their teachers who encourage involvement and discussions in classes (Paswan & Young, 2002; Ismail et al., 2017). Rai (2007), Norman (2005) advanced that STAD is one

cooperative learning strategy that boosts not only collaboration and but also independent learning at the same time. This strategy is very applicable and adaptable to different levels of students since classes are organized based on heterogeneous groupings. It is also ensured that students should have accelerated learning since STAD converges on the precepts that students work together to learn and at the same time would be responsible for their learning.

Some theories and researches had been fostered to promote cooperative learning strategies in the classroom. Wyk (2010), who used STAD to determine the economic literacy levels of students. In a school context, communication is a process of how teachers share their experiences with their students and vice versa. Every teacher has his or her knowledge and experiences. When teachers deliver their knowledge and share their experiences with their students, this process is defined as communication. In the process of exchanging experiences and knowledge between both

¹corresponding author - email: nazar@unsyiah.ac.id – address: Darussalam, Banda Aceh, Indonesia

teachers and students, they can create a sense of meaning amongst them. In terms of communicating at school, both teachers and students have their own sets of experiences and knowledge to share. Hence, when they communicate, they are expressing each other's experiences and knowledge and with that, they can develop a sense of meaning from the exchange.

Students also appreciate interactive methods which focus on them (Abrantes et al., 2007; Amiruddin et al., 2020), and would often want to and need to ask and state their doubts on what they have learned, analyzed, and compare the response of one to the other (Thorpe, 2001). If students have a strong and open bond with their teachers, they will have the initiative to invest and get more involved in the learning process, hence creating a more positive view on teachers and the learning methods.

An educator, method, and the learning environment are seen as the most effective if students are involved proactively in the teaching and learning process (Peltier et al., 2005; Sumarwati et al., 2020). Researchers have found that students' involvements are the most effective due to pedagogical interaction and communication between students and their peers including teachers (Hay et al., 2004). In this research, pedagogical factors are vital in creating a productive learning environment, thus enabling a better academic achievement, if the environment of the classroom actively involves potential students to stimulate self-development and regulatory learning (Young, 2005).

The interaction and communication skills between the relationship of students and teachers are needed to achieve the involvement of students and their interest in the learning process (Hay et al., 2004; Faranda & Clark, 2004). Empirical research has shown that positive pedagogical interaction and communication provides an effective learning environment that can help improve learning outcomes (Paswan & Young, 2002; Hay et al., 2004; Cornelius-White, 2007; Peltier et al., 2003; Cardoso et al., 2011) as students are more likely to choose a more interactive learning method and student-focused (Abrantes et al., 2007).

Students' communication supports and encourages them to achieve a higher cognitive level and to find a personal meaning of learning (Dempsey et al., 2001). This communication can happen in or out of the classroom, through the traditional or Jigsaw method (Abrantes et al., 2007; Hay et al., 2004; Peltier, et al., 2003). Several writers have suggested that students' communication, be it through a formal structure or spontaneous, can enrich the learning outcome through communication, resulting in students getting a better learning comprehension and more committed to resuming learning (Hay et al., 2004). This study reviewed the effects of the STAD cooperative learning strategies model compared to the traditional method of

communication skills in economic subjects among secondary school students in Aceh. The study also aims to identify the relationship between changes in communication skills of students in economic subjects which are influenced by family income. Besides, this study is to evaluate the student's perceptions of the teaching and learning process in the economic subject

The STAD-type Cooperative Model was developed by Robert Slavin and his colleagues at Johns Hopkins University. According to Slavin (2013), STAD is one of the simplest cooperative learning models, and most widely used model in cooperative learning. In cooperative learning with the STAD model, students are placed in study groups with different academic abilities, so that in each group there are students with high, medium, and low achievements or variations in gender, racial and ethnic groups, or other social groups. The teacher makes activity plans and delivers teaching materials to each group. The teacher gives the direction to do the task and determine the time allocated. Students work in groups to improve the learning materials either through discussion or looking for additional materials and so on. Each student helps other members in the group to ensure group success. At the end of the learning, group members take a test or quiz or make individual presentations. The scores obtained by each group member are added up to get the group score. One model that is suitable to be applied to economics learning is the Student Team Achievement Division (STAD) type of cooperative learning model. The STAD type of cooperative learning model is one of the simplest cooperative methods, easy to implement and best model for the introduction for the teachers who are new to use the approach in the teaching and learning process.

The Jigsaw II and STAD methods have different characteristics. According to Rattanatumma . T (2013); Jolliffe (2005) Jigsaw method requires the involvement of all students in gathering information about the titles of the discussion. This method requires the formation of two groups, namely the home group and the expert group. The home group is the basic group formed to gather the information of the members of this house group are broken down to form an expert group. In the expert group, each student will discuss the certain subtitle to prepare the assignment given to the home group. It gives each member in the home group an opportunity to contribute ideas to produce a group assignment. Based on the description above, it can be concluded that the Jigsaw, TGT and STAD learning methods have different effects on learning achievement. TGT cooperative learning method, the orientation is to increase learning motivation and interaction between fellow students. This academic style game can run every week or based on the needs of the title studied. The principle is almost the same as for STAD, but individual exams, quizzes and presentations

using questionnaires as the means of obtaining information. The questionnaires used are based on the instrument done by Azwani (2012) with the title of The Effect of STAD Model on Values of Patriotism, Attitude, and Student's Communication Skills in History subject. This instrument has been modified by researches based on the subject taken by the respondents. The communication skills instrument presents the question of communication skills in economic learning practiced by students. Students are required to fill out this questionnaire which is on communication skills practiced by students during economic classes in school. This Communication Skill is measured through a set of questionnaires. This set of questionnaires consists of nine questions. There are four items in terms of verbal/oral communication and five items to measure non-verbal communication aspects.

The questionnaires for this study are in the form of a Likert scale. This scale contains a series of statements on factors that influence student's communication skills. For each statement, respondents are required to give their statements on the items that prepared according to the Likert scale which is '1' Strongly Disagree, '2' Disagree, '3' Uncertain, '4' Agree and '5' Strongly Agree. A pilot study conducted, to determine the validity and reliability of instruments. Based on the analysis, the Cronbach Alpha value is 0.848. This finding shows that the items in this study reliable and valid. The student's communication skills instrument refers to some social behavior of students in establishing relationships between students such as giving out ideas, suggestions, exchanging thoughts, verbal and non-verbal communication, or physical cues. Non-verbal communication in this study is interaction. Interaction refers to the process of communication by various parties by supporting, helping, and giving feedback through interdependence between members of the group. For instance, members who are good at helping less knowledgeable members.

3. Results

Descriptive analysis and inferential analysis of Post Tests are conducted on dependent variables, namely communication skills, in economic subjects. Furthermore, an analysis of open-ended questions regarding the student's perception of learning strategy is also shown.

3.1 Mean value for the experimental group and controlled group

Table 1 shows Pre Test levels for all variables of the study are at a low and average level for both the Controlled and Experimental Group.

Table 2 shows for Post Test, there is an increase recorded for all variables of study for both groups. It is also found that there is a better increase of mean value for the Experimental Group compared to the mean value increase for the Controlled Group. In essence, it is found that for the Post Test, the variable of communication skills is high for Experimental Group, and at an average level for the economic subject. Meanwhile, for the Post Test of Controlled Group, there were none of the variables that recorded a high level of result.

3.2 Mean difference for student's communication skills in an economy subject

Descriptive statistical data have shown that there is a mean value difference recorded for all variables of study where the mean value for Experimental Group are higher in the Post-test. Inferential statistical analysis is then followed to test out whether the mentioned mean value is significant or otherwise. A T-Test is used to compare the mean value for all variables of the study, namely communication skills, students' attitude towards the economy, and students' achievement in economic subjects.

Table 3 shows T-Test results on dependent variables of communication skills in the economic subject for the Post-test. There is a significant mean difference for student's communication skills in Economy subject $t(29) = 5.23, p=0.05$.

Table 4 shows the mean value score for dependent study variables of students' communication skills in the economic subject for the Post Test of both Controlled Group and Experimental Group. The mean value score and the standard deviation of both groups are used to determine the size of impact based on Cohen's method (Cohen, 1988). Wolf (1986) stated that generally, any Cohen's d value that is greater than 0.25 indicates a significant learning effect. Cohen's d value for the variable of students' communication skills is 0.289. This shows that the effect of the Jigsaw II model in Cooperative Learning is significant.

3.3 Contribution of students' communication skills on the economy in the economic subject towards achievement before being exposed to the cooperative learning of STAD model

Regression tests were conducted to identify whether there is an independent variable contribution to the dependent variable (Chua, 2006; Mokhtar, 1994; Coakes et al, 2010). In this research, multiple regression analysis was carried out to predict the influence of some independent variables (predictors) on dependent variables (criteria).

In this study, researchers are looking at the extent of how the variable of communication skills and attitudes

Dependent Variable	Method	N	Mean Test	Pre Standard Deviation	Level
Communication Skills	Controlled	30	2.47	0.57	Low
	Experimental	30	2.70	0.41	Low

Table 1 - Pre Test for Controlled and Experimental Group.

Dependent Variable	Method	N	Mean Test	Post Standard Deviation	Level
Communication Skills	Controlled	30	3.40	0.70	Average
	Experimental	30	4.10	0.50	High

Table 2 - Post Test for Controlled and Experimental Group.

Dependent Variable	Df	T	P	Result
Communication skill	29.00	5.23	0.00	A significant difference in mean

Table 3 - t-test Results for Post Test.

Dependent Variable	Controlled	(N = 30)	Experimental	(N = 30)	Cohen's d Size of Impact
	Mean Score	Standard Deviation	Mean Score	Standard Deviation	
Communication skills	3.40	0.70	4.10	0.50	0.289

Table 4 -Mean Value of Dependent Study Variable and Size of Impact for Post-Test.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig	Statistic	Df	Sig
Communication skills	.100	60	.200*	.954	60	.023

Table 5 - Normality Test.

Variables	B	Beta(β)	T-value	Sig-t	R ²	Contribution(%)
Communication skills	1.757	0.093	0.709	0.481	0.009	0.09
R Doubled	0.357					
R The power of two	0.127					
R Modified The Power of Two	0.097					
Standard Error	9.117					

Table 6 - Multiple Regression Analysis for Independent Variables that Affect Students' Achievement in Economic Subject (pre-treatment).

Source	Total of the Power of Two	Degree of Freedom	The Mean of the Power of Two	F-Value	Level of significance (p)
Regression	690.936	2	345.468	4.156	0.021
Residual	4737.797	57	83.119		
Total	5428.733	59			

Table 7 - Variance Analysis

towards achievement before being exposed to the cooperative learning of the Jigsaw II model. Tables 6 and 7, displays multiple regression coefficients involving two independent variables on dependent variables which is student achievement. Two related independent variables are showing a correlation and insignificant contribution ($p < 0.05$) towards the total variant of student's achievement.

The main predictor and the achievement of students in the economic subject before the cooperative learning strategy of the STAD model conducted are to inculcate a positive attitude towards the economy through the course of economic subjects ($\beta=0.332$, $t=2.678$ dan $p=0.010$) and contributes to a total of 11.00 percent. This situation shows that when the score of positive attitude towards the economy through the course of economic subjects increased one unit, hence, the student's achievement increases by 0.332 unit. This finding shows that the positive attitude towards the economy through the course of economic subjects before treatment was conducted by 11.00 percent to the achievement of students in economic subjects among the students who undergo the cooperative learning strategy of the STAD model. The second predictor is communication skills issue negatively affects 0.09 percent towards students' achievement level among students who are involved in the economic course of the subject before treatment was conducted ($\beta=0.093$, $t=-0.709$ dan $p=0.009$). This shows that when the score of colleagues' communication skills issues increases by one unit, students' achievement would decrease by 0.093 units. Thus, if communication skills issues between colleagues increases, then the achievement among students who are involved in the course will decrease.

Based on the table above, the criteria of variables in this research post-test achievement, while the predictor variable is the dimension of communication skills and attitude towards the economy. The results obtained in

the table explain the predictor's attitude towards the economy does not contribute significantly towards students' achievement for all respondents among students. The findings of the study have shown that the dimension of attitude towards the economy is the dominant predictor compared to communication skills. Therefore, there is no significant contribution between the variables of communication skills and attitude towards the economy, on the achievement in economic subjects according to the respondents among students as a whole is accepted. Findings have shown that both variables are insignificant contributors to the achievement of economic subjects.

3.4 Relationship between attitude change and students' communication skills in the economic subject that is influenced by family income

To determine the attitude change and students' communication skills in the economic subject are influenced by family income for Post Test, the Pearson correlation test is used. Correlation test has shown that there is no significant relationship between attitude change and students' communication skills in the economic subject that are influenced by family income. Significant relationship with a low correlation level is communication skills ($r = -0.65$, $p = 0.623$ and attitudes towards the economy ($r = -0.39$, $p = 0.770$).

In viewing the relationship between income and communication skills with the attitude towards the economy, it can be concluded that attitude change and students' communication skills in the economic subject are not influenced by family income.

3.5 Relationship between communication skills with students' achievement in the economic subject

To observe the relationship between communication skills with students' achievement in the economic subject for Post Test, the Pearson correlation test is

Variables	Family	Income
	(r)	Sig.(p)
Communication skills	- 0.65	0.623
Attitude towards the economy	- 0.39	0.770

*Correlation at a confidence level of 0.05

Table 8 - The correlation of attitude change and communication skills with family income.

The relationship between variables	R	P	N
Communication skills and academic achievement	.300	.020	60

*Correlation at a confidence level of 0.05

Table 9 - The correlation between communication skills and academic achievement.

used. Correlation test has shown that there is a significant relationship between communication skills with students' academic achievement in the economic subject, even though the number is relatively low ($r = .300$, $p > .020$). Hence, there is no significant relationship between communication skills and students' academic achievement is invalid. In viewing the relationship between communication skills and students' academic achievement, it can be concluded that the changes in communication skills can influence students' academic achievement.

4. Discussion and Conclusions

The purpose of this research is to observe the effectiveness of STAD model for cooperative learning activities and direct orders in promoting effective communication skills for secondary school students, a positive attitude towards the economy as well as improving students' academic performance. Short term interventions have been implemented to encourage communication skills. In STAD cooperative learning, the opportunity to cooperate and interact with classmates is higher compared to traditional learning. The effects of this can cause students to receive responses that can enhance their understanding during the learning process. Students assist in the learning process of other students by sharing information, discussion, and teaching what they have understood and encourage them to achieve a better result. This study has found that students who are taught with the STAD cooperative learning method can demonstrate and enhance communication skills among students. Students' communication skills can be demonstrated in the study that was conducted. The communication interaction between classmates in class can indirectly be shown when students communicate with each other to solve current learning difficulties within the group. The unique aspect of teaching and learning in this research is the cooperative group structure which allows students to learn and practice communication skills within an interdependent group. This structure provides an opportunity for students to engage in social interaction, positive interdependence, and mutual trust. The cooperation in a group given by students can be instilled with the necessary support from peers for each student, not only to learn the steps to identify the social communication identity but to also use skills in various situations.

The generalization of communication skills across the environment has been programmed in three ways. First, the overall generalization of communication skills acts as a dependent variable. Skills have been taught in a day and students are requested to carry out communication skills learning the following day. Secondly, a mediational strategy has been established to encourage

the generalization of social learning communication skills. Thirdly, are the students expected to engage in a problem-solving activity with their groupmates who served as an encouragement to promote social communication habits among students. However, the results show that STAD cooperative learning activities and direct orders are effective in enhancing the social communication skills of secondary school students. The main findings in this study are that the approach of Jigsaw II cooperative learning is more effective, better compared to the traditional learning in overall students' communication skills. The first finding, in the areas of equal participation and accountability, STAD cooperative learning is found to be more effective than traditional learning in enhancing students' communication skills.

In line with the previous research, the results support the statement that students can be taught communication skills (Mathur & Rutherford, 1994; Gomleksiz, 2007; Sachs et al, 2003). Students can benefit from the approach of Jigsaw II cooperative learning which includes cooperative learning, interdependent, individual responsibility and group accountability, face-to-face interactions, the development of interpersonal social skills, and group processing.

The findings are encouraging where the nature of positive dependency to share is what should have been practiced by students to increase their knowledge to be used through discussions. They refer to multiple references and in the event of confusion and misunderstanding, they can ask each other for certainty. This skill is necessary and important in a problem-solving process. This research is in line with empirical research (Paswan & Young, 2002; Hay et al, 2004; Cornelius White, 2007; Peltier et al, 2007; Cardoso et al, 2011; Basyah, N. A., et al, 2018) that shows that pedagogical interaction and positive communication provide effective learning that can improve the outcome learning as students are likely to choose more interactive teaching methods and student-focused (Abrantes, Seabra & Lages, 2007; Effandi, 2003) where students should be encouraged to study in groups as any problems encountered can be helped by colleagues in the group positively.

Through face-to-face interactions, members in the group mutually encourage the success of other members of the group and this goal can be achieved when each member helps one another. In fulfilling this communication skill, students need to discuss and interact in the group through face-to-face interactions. This interaction can help ease students to discuss and help one another. Besides, students will also gain the skills to interact face-to-face to create a harmonious discussion environment, creating an enjoyable teaching and learning process. Numerous studies in western countries show that STAD cooperative learning not

only aids in enhancing students' achievement but is also effective in improving students' group achievement, communication skills with others Johnson et al. (2007) and Kagan (2006).

The main findings of cooperative skills support the assertion that numerous STAD cooperative learning models support a positive outcome derived from peer student interaction is the enhancement of interpersonal and social skills (Kagan & Kagan, 2009; Slavin, 1995). Waugh et al (2005) are also mentioned in their study, students from experimental classrooms show more positive communication skills behavior than they do in traditional classes. The basic principle of STAD cooperative learning was fully integrated into the learning method used in this study. For instance, randomly selecting individual students and assigning group role assignments (Ning, 2011). This can stimulate the group members and their accountability to obtain success for the group.

A mutual understanding is key to promoting interaction among students and successful communication. In STAD cooperative learning in groups, students feel motivated and are required to use skills: such as offering or requesting themselves to be understood by group members and also understanding others, only then the success of the group can be achieved. This can be explained in this study that cooperation in a group is very relevant and communication skills are better compared to the controlled group. According to Slavin (2011), from a development perspective, the Jigsaw II cooperative learning teaching method helps students to achieve their objectives through encouragement and facilitation by members in their groups.

Students in the STAD cooperative learning class have more opportunities to interact and communicate with each other, and they enjoy the experience as new knowledge they have acquired or learn new things about the economy. On top of that, STAD cooperative learning is heterogeneous between group members as they understand each other. The difference in circumstances has been utilized to comprehend that at each group work level in cooperative classes, peer interactions are rare in traditional classes, and understanding is mainly used as a downward process by teachers. Consequently, interaction can be practiced through interactive activities as provided in the STAD cooperative learning teaching method, where students teach and learn from one another hence creating a positive interdependence by offering help related to assignments and encouragement to contribute to each other for activities or topics which was assigned to them (Marr, 1997; Slavin, 2011).

Students' communication skills can be assessed by students in terms of how they are allowed to learn from one another, and they are also encouraged to contribute, making their interactions between other peers on the

important materials in learning (Hay et al., 2004). Previous studies have revealed that the level of communication and the high interaction of students can improve the quality and be seen as learning experiences and have a positive influence on learning outcomes (Hay et al., 2004; Peltier et al., 2003; Cardoso et al., 2011; Morsidi S et al., 2021). When teachers and students actively engage and participate in communication, knowledge building, the learning environment is seen to be more effective. Therefore, the level of learning performance will also increase. Based on the data collected from the questionnaires in this research, the researchers have developed a profile and found that the communication skills pattern, students' attitude towards the economy, and the learning style practiced by students changed after classes in 14 weeks (one semester). The cooperative learning strategy of the STAD model is a bit of a factor, and the cause of profile change, communication skills, students' attitude towards the economy, and learning styles practiced by students before and after the treatments implemented. The students have positive attitudes toward economic. They have recognized the integrative and instrumental benefits of economics. Students exposed to STAD have enhanced academic performance in economics than students employed with the traditional teaching method. It concluded that STAD is one of the contemporary strategies is more effective than the traditional teaching method of teaching economics. Positive attitudes toward the attainment of the course are learning outcomes and better academic performance in economic.

In conclusion, STAD cooperative learning in economics is well suited to students' emotional needs in providing a learning environment and giving support that encourages their motivation towards effective communication. However, for students who have no motivation to learn or go to school, teachers are responsible for making sure they have the opportunity to interact with other people and receiving the help needed in adapting to group learning activities. Teachers need to understand the personality of each student, making observations and records in STAD cooperative learning, for them to help students understand the knowledge of economics subjects.

References

- Abdul, H., Lilia, H., Subahan M. & Kamisah, O. (2010). Development of Science Problem Solving Instruments Jurnal Pendidikan Malaysia, 35 (1): 35-39. <http://journalarticle.ukm.my/140/>
- Abrami, P. C., Poulsen, C. and Chambers, B. (2004). Teacher motivation to implement an educational innovation: Factors differentiating users and non-

- users of cooperative learning. *Educational Psychology*, 24 (2). 201-216.
- Abrantes, J. L., Seabra, C., & Lages, L. F. (2007). Pedagogical affect, student interest, and learning performance. *Journal of Business Research*, 60(9),: 960-964. <https://doi.org/10.1080/0144341032000160146>
- Abu, B. N. (1995). *Fundamentals of educational evaluation*. Petaling Jaya: Longman Malaysia Sdn Bhd.
- Adeyemo, S. A. (2012). The relationship between effective classroom management and students' academic achievement. *European Journal of Educational Studies*, 4(3), 367-381.
- Adiwarman, A. K. (2007). *Islamic Microeconomics*. Jakarta : PT Rajagrafindo Persada.
- Ajzen, I. (2005). *Attitudes, personality, and behavior*. McGraw-Hill Education (UK).
- Aladejana, F. & Aderibigbe, O. (2007) Science laboratory environment and academic performance. *Journal Science Educational Technology* 16 (6), 500-506. <https://doi.org/10.1007/s10956-007-9072-4>
- Albarracin, D., Johnson, B.T., & Zanna, M.P. (2014). *The Handbook of Attitudes*. Routledge.
- Alhaidari, M. (2006). *The Effectiveness of Using Cooperative Learning to Promote Reading Comprehension, Vocabulary, and Fluency Achievement Scores of Male Fourth-and Fifth-grade Student in a Saudi Arabian School*. Tesis P.hD. The Pennsylvania State University. <https://www.proquest.com/openview/d548c2d74c7a98282cf9f698f6572f33/1?pq-origsite=gscholar&cbl=18750&diss=y>
- Ali Reza Jalilifar. (2010). *The Effect of Cooperative Learning Techniques on College Students' Reading Comprehension*. *System*,38(1), 96-108. <https://doi.org/10.1016/j.system.2009.12.009>
- Ali, E. (2004). *The Effects Traditional A Learning Cycle Inquiry Learning Strategy on Student Science Achievement and Attitudes Toward Elementary Science*. Thesis P.hD Ohio University.
- Allport, G.W., Blanshard, B., Morgan, A. Sullivan, R. Taylor, H., & Klein, J. (2005). *The Goals of Higher Education*. California: Experienced Books.
- Amiruddin, M. H., Ismail, I. M., Razali, N., Ismail, M. E., Doman, N., Samad, N. A., & Rahim, A. A. (2020). The Motivation Level towards the Application of Google Apps among Part-time Students: A Case Study. *Journal Of Technical Education and Training*, 12 (1)i, 254–260.
- <https://publisher.uthm.edu.my/ojs/index.php/JTET/article/view/3179>
- Aronson, E., & Patnoe, S. (2011). *Cooperation in the classroom: The jigsaw method*. London, England: Pinter & Martin Ltd.
- Azizi, Y., Ahmad, J. S., & Shazalina, G. (2007). *Cooperative Learning Practices Among Technical and Vocational Subject Teachers in Three Technical Schools in Selangor*. *Jurnal Teknologi Pendidikan*. Universiti Teknologi Malaysia.
- Azizi, Y., Asmah, S., Zurihanmi, Z., & Fawziah, Y. (2005). *Cognitive Applications in Education* Kuala Lumpur: PTS Profesional Publisng Sdn. Bhd.
- Azizi, Y., Shahrin, H, Jamaluddin, R., Yusof, B., & Abdul, R. H. (2006). *Mastering Research in Education*. Kuala Lumpur: PTS Profesional Publisng.
- Azwani, I. (2012). *The Effect of STAD Model On Students' Patriotism Values, Attitudes and Communication Skills in History Subjects* Tesis P.hD. Bangi: Universiti Kebangsaan Malaysia.
- Baltes, MM. (1996). *The Many Faces of Dependency in Old Age*. New York: Cambridge Univ. Press.
- Bandura, A. (1993). Perceived Self-Efficacy in Cognitive Development and Functioning, *Educational Psychologist*, 28(2), 117-148, DOI: 10.1207/s15326985ep2802_3
- Bandura, A. (1997). *Social Learning Theory*. New York: General Learning Press.
- Bandura, A. (2005). *Aggression: A Sosial Learning Analysis (The Prentice-Hall Series in Social Learning Theory)*. Georgia: Hippo Books.
- Basyah, N. A., Muslem, A., & Usman, B. (2018). The effectiveness of using the jigsaw model to improve students' economics teaching-learning achievement. *New Educational Review*. Stanisław Juszczak, 51(1), 30-40. DOI: 10.15804/ner.2017.50.4.02
- Becker, W.E., & Watts, M. (2010). Teaching Methods in U.S. Undergraduate Economics Courses, *The Journal of Economic Education*, 32(3), 269-279. DOI: 10.1080/00220480109596108
- Behrangi MR. (2012). *New patterns of teaching*. Tehran, Kamale tarbiyatpress.
- Berscheid, E. (1994). Interpersonal relationships. *Annual Review of Psychology*, 45(1), 79-129. <https://doi.org/10.1146/annurev.ps.45.020194.000455>

- Bertucci, A., Conte, S., Johnson, D.W., & Johnson, R.T. (2010). The Impact of Size of Cooperative Group on Achievement, Social Support, and Self-Esteem, *The Journal of General Psychology*, 137(3), 256-272. DOI: 10.1080/00221309.2010.484448
- Bowen CW. (2000). A quantitative literature review of cooperative learning effects on high school and college chemistry achievement. *J. Chem. Educ.*, 77(1), 116-119. <https://doi.org/10.1021/ed077p116>
- Brewer, S., & Klein, J. D. (2006). Type of positive interdependence and affiliation motive in an asynchronous, collaborative learning environment. *Educational Technology Research and Development*, 54(4), 331–354. <https://doi.org/10.1007/s11423-006-9603-3>
- Briggs, S.A. (1994). *Counseling student through their individual learning*. Massachusetts: Allyn and Bacon.
- Briner, M. (1999). *What is Constructivism?* University of Colorado at Denver School.
- Brooks, T. J., & Khandker, A. W. (2002). A collaborative learning lab: Does the form matter?. *Contemporary Economic Policy*, 20(3), 330-338. <https://doi.org/10.1093/cep/20.3.330>
- Bryman A. (2004). *Social Research Method 2nd edition*. UK : Oxford University Press.
- Bryman, A., & Cramer, D. (2005). *Quantitative data analysis with SPSS 12 and 13: a guide for social scientists*. Psychology Press. <https://doi.org/10.4324/9780203498187>
- Cambell, D.T., Stanley, J.C. (1963). *Experimental and Quasi-experimental designs for research*. Chicago: Rand Mc nally.
- Cardoso, A. P., Ferreira, M., Abrantes, J.L., Seabra, & C., Costa, C. (2011). Personal and pedagogical interaction factors as determinants of academic achievement. *Procedia – Social and Behavioral Sciences*, 29, 1596-1605. <https://doi.org/10.1016/j.sbspro.2011.11.402>
- Case, Karl E. & Ray C Fair, (2007). *Principles of Economics, Eight Edition*, Pearson Education, Inc, Upper Saddle River, New Jersey.
- Chamot, A. U., P Beard El-Dinary dan J Rubins (1999). *The Learning Strategies Handbook*. White Plains, New York: Addison Wesley.
- Chang, M. J., & De Angelo, L. (2002). Going Greek: The effects of racial composition on white students' participation patterns. *Journal of College Student Development* 43(6), 809-23. <https://eric.ed.gov/?id=EJ657083>
- Charles, C.M. & Mertler, Crag A. (2002). *Introduction to Educational Research (4th Ed)*. Boston, MA: Allyn & Bacon.
- Charles, C.M., Mertler, C.M. (2002). *Introduction to Educational Research*. Boston A Pearson Educational Company.
- Cheung, L. & Kan, A. (2002). Evaluation of factors related to student performance in a distance-learning business communication course. *Journal of Education for Business*, 77(5), 257-263. <https://doi.org/10.1080/08832320209599674>
- Chu, S. Y. (2014). Application of the Jigsaw Cooperative Learning Method in Economics Course. *International Journal of Managerial Studies and Research*, 2(10), 166-172.
- Chua, Y. P. (2006). *Research Methods and Statistics Book 1: Research Methods* Kuala Lumpur: McGraw Hill (Malaysia) Sdn Bhd.
- Coakes (2010). *SPSS Version 17 for Windows, Analisis Without Anguish*. Queensland: John Wiley and Sons Australia Ltd.
- Cohen, E.G (1994). *Designing groupwork: Strategies for heterogeneous Classrooms*. Revised edition New York: Teachers Colleges Press.
- Cohen, L., Manion, L., Morrison, K. (2003). *Research methods in education*. Routhledgefalmer: London and New York.
- Conrad, C., & Poole, M.S. (2002). *Strategic organizational communication in a global economy (5th ed)*. New York: Harcourt.
- Cornelius-White, J. (2007). Learner-centered teacher-student relationships are effective: A meta-analysis. *Review of Educational Research*, 77(1), 113-143. <https://doi.org/10.3102/003465430298563>
- Crano, W. D., & Prislin, R. (2006). Attitudes and persuasion. *Annu. Rev. Psychol.*, 57, 345-374. <https://doi.org/10.1146/annurev.psych.57.102904.190034>
- Crano, W.D., & Prislin, R. (2006). Attitudes and Persuasion. *Annual Review of Psychology*, 57, 345-374. <https://doi.org/10.1146/annurev.psych.57.102904.190034>
- Faranda, W. T., & Clarke I. I. (2004). Student observations of outstanding teaching: Implications for marketing educators. *Journal of Marketing Education*, 26(3), 271-281. <https://doi.org/10.1177/0273475304268782>
- Hay, A., Hodgkinson, M., Peltier, J., & Drago, W. (2004). *Interaction and virtual learning*. Strategic
© Italian e-Learning Association

- Change, 13(4), 193-204.
<https://www.proquest.com/openview/af2e4a59fecc869a4872372b6acd9e74/1?pq-origsite=gscholar&cbl=31335>
- Ismail, M.E., Irwan Mahazir, I., Othman, H., Amiruddin, M.H., & Ariffin, A. (2017). The Use Of Animation Video In Teaching To Enhance The Imagination And Visualization Of Student In Engineering Drawing. Science and Technology International Conference. IOP Conf. Series: Materials Science and Engineering 203, 1-8.
- Paswan, K., & Young, J. A. (2002). Student evaluation of instructor: A nomological investigation using structural equation modeling. *Journal of Marketing Education*, 24(3), 193-202. <https://doi.org/10.1177/0273475302238042>
- Peltier, J. W., Hay, A., & Drago, W. (2005). The reflective learning continuum: Reflecting on reflection. *Journal of Marketing Education*, 27(3), 250-263. <https://doi.org/10.1177/0273475305279657>
- Phipps, B.J., & Clark, J.E. (1993) Attitudes Toward Economics: Uni- or Multidimensional?, *The Journal of Economic Education*, 24(3), 195-212. DOI: 10.1080/00220485.1993.10844792
- Rai, N., & Samsuddin, S. (2007). STAD vs Traditional teaching, Redesigning Pedagogy crpp conference 2007.
- Rattanatumma, T., & Puncreobutr, V. (2013). Using Jigsaw Technique as an Effective Way of Promoting Co-Operative Learning Among Primary Six Pupils in Fijai. *International Journal of Education and Practice*. DOI 10.18488/journal.61/2013.1.6/61.6.64.74
- Sumarwati, S., Fitriyani, H., Setiaji, F. M. A., Amiruddin, M. H., & Jalil, S.A. (2020). Developing Mathematics Learning Media Based on Elearning Using Moodle on Geometry Subject to Improve Students' Higher Order Thinking Skills. *Interactive Mobile Technologies (iJIM)*, 14(4), 182-191.
- Suraya Morsidi, Norazrena Abu Samah, Khairul Anuar Abdul Rahman, Zakiah Mohamad Ashari, Nurul Farhana Jumaat, Abdul Halim Abdullah (2021). WhatsApp and Its Potential to Develop Communication Skills among University Students <https://doi.org/10.3991/ijim.v15i23.27243>
- Thorpe, R. (2001). Rod Thorpe on teaching games for understanding. In L. Kidman (Ed) *Developing decision makers. An empowerment approach to coaching*. Auckland, New Zealand: Innovative Print Communication Ltd.
- Wyk, M. (2009). Do Student Teams Achievement Divisions Enhance Economic Literacy? A Quasi Experimental Design. Available <http://www.krepublishers.com/02-Journals>
- Young, M. R. (2005). The motivational effects of the classroom environment in facilitating self-regulated learning. *Journal of Marketing Education*, 27(1):25-40. <https://doi.org/10.1177/0273475304273346>

The New Normal: Online Classes and Assessments during the COVID-19 Outbreak

Rizwana Wahid^{a,1}, Oveesa Farooq^b, Ahtisham Aziz^c

^a*Faculty of Languages & Translation, King Khalid University – Abha (Saudi Arabia)*

^b*Department of Functional English, Women’s College, Cluster University – Srinagar (India)*

^c*Faculty of Arts & Humanities, Aligarh College of Education – Aligarh (India)*

(submitted: 19/8/2020; accepted: 18/12/2020; published: 22/12/2021)

Abstract

The current quantitative research paper intends to investigate students' and teachers' experiences and opinions about virtual learning and testing and how remote learning has affected their teaching and learning and assessments during the pandemic. To find out the effects of the online platform on classes and assessments, two sets (one for students and the other for teachers) of questionnaires were formulated comprising three sections; first, about demographic information of the participants, second (variables, 1-8) about online classes and third (variables, 9-17) about online assessments. The questionnaires were administered among 150 participants- 90 students and 60 teachers from five countries: Saudi Arabia, India, Turkey, England and Canada. SPSS (Statistical Package for the Social Sciences)-version 26.0 was used to analyze the data statistically. The results showed that both students and teachers faced challenges in adopting online teaching, yet they had to do so out of necessity because they did not experience online teaching especially online assessment up to the standard of face-to-face (in person in classrooms). Moreover, the research findings did not show much significant difference between teachers' and students' experiences and opinions towards online classes and assessment across all five countries. Furthermore, the study offers some implications based on the findings. The researchers see that blended learning might be the future of education. Unified online curricula and learning management systems, competency in using various digital tools/platforms, availability of stable Internet connection, innovative and engaging teaching strategies and proctored exams and a variety of formative/summative assessments are required in order to maintain the quality of learning and testing, and prepare educational institutions and teachers to meet any challenge in this unpredictable world.

KEYWORDS: COVID-19, Face-To-Face Teaching, Online Classes, Online Assessment, Online Teaching.

DOI

<https://doi.org/10.20368/1971-8829/1135346>

CITE AS

Wahid, R., Farooq, O., & Aziz, A. (2021). The New Normal: Online Classes and Assessments during the COVID-19 Outbreak. *Journal of e-Learning and Knowledge Society*, 17(2), 85-96. <https://doi.org/10.20368/1971-8829/1135346>

1. Introduction

The whole world has faced changes and challenges due to the outbreak of COVID-19. It has also shaken the education system worldwide. The higher education system across the world is affected too by it to a larger extent. After WHO's (2020, 11 March) declaration of

the coronavirus disease a pandemic, universities and colleges all over the world have been closed for an unknown period, and teachers and students have experienced disruption, educational challenges and sudden shocks because of transformation from face-to-face classes (presence on campus) to virtual classes (UNESCO, 2020, 13 March). The sudden closure of educational institutions turned the hitherto optional mode of online learning into a compulsory one due to the non-availability of any other option. Consequently, all stake holders; teachers, students and parents were caught unawares as neither the students and parents nor the teachers or institutions were prepared for the online mode of teaching, learning and testing. This new mode of education brought about many intrinsic changes in the system and these new dynamics have a bearing on all dimensions of the teaching learning process. The

¹ corresponding author - email: rizuwahid@gmail.com

new ecosystem of virtual learning has transformed the mode and manner of content delivery by the teachers and has altered the student response to the system as well.

Online teaching, learning and testing have brought many challenges for language learners and teachers. Therefore, the present research aims to report some experiences and opinions of teachers and students from different universities to draw attention to online teaching/learning and assessment issues and how online platforms affect achieving the desired outcomes of language learning, teaching and testing.

An online classroom can be defined as a room that is fully involved in technology. In this kind of teaching, the whole syllabus is taught online via the internet using different digital tools. Online teaching or eLearning has made it possible to continue learning during COVID-19. At the same time, the forced transformation from traditional to online classes has its challenges and issues. It has burdened teachers and students to use new technologies and discover effective online teaching and learning strategies. It has cleared how important it is to grow professionally and reflect on online teaching effectiveness and success. The crisis also opens the possible doors of better opportunities (Li & Lalani, 2020; Agarwal & Kaushik, 2020). In the future, higher education across the world, face-to-face (presence in classrooms) teaching can sustain only with the blending of technologies.

1.1 The Rationale of the Research

Due to the outbreak of the pandemic, it is evident that university students and teachers have faced many challenges i.e., finding the right online platform, technical issues, attendance and a lack of knowledge in adapting to the online classes. During the transformation from face-to-face on campus to online classes, teachers and higher education were not ready. It was a sudden shift with no other option. Teachers and students have struggled to make the online classes effective and online assessments valid. Especially for university teachers, it has not been easy to choose the correct way to examine their students' performance and justify their results.

In the emergence of COVID-19, a massive, quick and forced transformation from face-to-face classes and assessments to virtual classes and assessments has become the new normal. Many studies have reported about online teaching and assessments, and teachers' and learners' experiences and perceptions during the coronavirus pandemic. Bao (2020) shares one Chinese university teachers' teaching experiences about online teaching. On the basis of their experiences, she has suggested six specific pedagogical strategies to overcome the challenges posed by the pandemic. To face this sudden transformation from face-to-face setting to online setting, her research offers five effective principles: relevance of online course plans

with students' learning, teachers' successful and effective delivery of lectures/lessons, adequate support by teachers to students, students' participation and possible plans to mitigate the effects of unexpected problems of online teaching. Huang *et al.* (2020) have also supported the notion of the flexible online teaching to face the challenges posed by the coronavirus pandemic. According to Allen, Rowan and Singh (2020) in the time of COVID-19, the increased workloads for instructors due to shifting the teaching materials into online mode have caused unequal pressure between teachers and learners. Not only teachers are moving the content into online content but they are also struggling to find an adequate online platform because some universities like in India do not have their own established LMS (Learning Management Systems) though other universities in Saudi Arabia, Turkey, England and Canada have. Digital education in India depends on mainly the videoconference systems (Zoom, Google Meet, Cisco Web, Microsoft Teams, etc.) while the other four countries have been using Blackboard, Moodle, Schoology, etc. even before the pandemic era. Therefore, institutional settings must build their own learning management systems to meet the standards of high-quality education. Yet it has to be observed through the outcomes of virtual teaching whether virtual teaching will open the doors to stupendous innovations broadly in terms of instructional strategies or instructors will use traditional ways to teach online. Jan (2020) has observed that teachers are not applying the new pedagogical strategies to cope-up with the present situation due to the lack of institutional support. So, they are making use of the traditional teaching style in online teaching. She points out the need to apply rapid and necessary pedagogical changes to cover the challenges of online teaching. Her study is limited to primary education as she seeks the views of Malaysian primary students' parents to investigate the use of different online platforms and the effectiveness of online teaching. In a broader context, Crawford *et al.* (2020) have also suggested redeveloping full online curricula by discussing the responses of different universities across 20 countries to COVID-19 threats to higher education differing from no response to quick response in developing full online curricula. They have suggested that universities can learn from one-another to fight back with the coronavirus pandemic through a unified response, such as making full online curricula. Further, the World Bank (2020) sees this pandemic as a good opportunity for curriculum designers and policymakers to learn from each other and to cooperate with each other to lessen the effects of the coronavirus pandemic. So, it cannot be denied that COVID-19 may work to bridge the gap of traditional and online learning through changes in curricula development, though the higher education system has been trying to incorporate online redevelopment of pedagogies at a slow pace in the pre-COVID-19 period (Raman, 2020; Nehal &

Khan, 2020). Li and Lalani (2020) and Minerva (2020) discover online transformation as a positive step towards the development of the education system. Minerva (2020) finds teachers and learners in educational institutions, could cope-up with the unprecedented time because they have digital technology. However, they have faced issues due to the lack of unified structure. The researcher looks at digital technology as a useful tool to improve learning in remote as well as on-campus environments. Similarly, Agarwal and Kaushik (2020) also recommend making online teaching as an integral part of pedagogical development beyond the crisis period in their research on 77 medical students in India. By collecting students' feedback responses after 12 days online sessions on Zoom, they have found online classes a good alternative to traditional teaching in the time of lockdown due to COVID-19. Their research has claimed online teaching is highly effective, interesting, and easy to use and adapt teaching materials according to the needs of learners. They have also advised to use the latest version of the software for the time being to deal with unprecedented technical problems. In fact, COVID-19 will be a transitional phase to change the structure of higher education setup from traditional to blended and full online pedagogies. It is going to be an integral part of post-COVID-19. After the application of diverse online platforms, the effectiveness and pitfalls of this drastic transformation will be measured and unprecedented technicalities of remote pedagogy and rapid changes in the education system may be overcome by interactive lectures (Ertmer *et al.*, 2011, Richardson *et al.*, 2016), coordination of colleagues, continuous professional development, improvement in IT structure and contingency plans for future (Devitt *et al.*, 2020). Their study on the second level school teachers in Ireland has recommended making changes on three levels; teaching (efficient teachers, best practice application, coordination among faculty members and professional development), learning (synchronous, interactive, motivating and student engaging online classes) and education system (advanced online platforms, development in IT infrastructure and supportive social context) in order to resolve challenges of remote learning as well as face-to-face learning. Richardson *et al.* (2016) has supported a caring environment and a good relationship between student and teacher for effective online teaching. Continuous professional development (Schon, 1983, Richardson & Diaz Maggioli, 2018, Shanjida *et al.*, 2018; Hasper, 2020) and reflective teaching strategies (Kolb, 1984; Hasper, 2020) are the key factors to grow and deal with any kind of change or in times of uncertainties in both the settings face-to-face and online. Being in the teaching profession, practitioners always must reflect on effective teaching strategies and evolve continuously in order to adapt changes and optimize teaching (Hasper, 2020).

Before the pandemic, a lot of studies are available on effective online teaching strategies and teachers' perception of eLearning and its successful application (Carter *et al.*, 2014; Frazer *et al.*, 2017). In qualitative research on 11 American nursing faculties who have 6-7 years online teaching experience Frazer *et al.* (2017) have also investigated teachers' perspective of online pedagogy and effective teaching strategies with some quality indicators to obtain desirable student success. According to them, efficacy of online teachers must be enough to apply some effective teaching strategies of eLearning such as regular synchronous online sessions, discussions, responses to discussions and grading of assignments. In the same regard, Dickinson and Gronseth (2020) have emphasized the application of online Universal Design for Learning with its effective teaching approaches, alternative modes of assessments and different means of communication to boost the student development.

Some studies have been reported here which discuss students' and instructors' views and experiences on online assessments. One observational research by Elzainy, El Sadik and Al Abdulmonem (2020) has reported the positive and satisfactory experiences of medical students and faculties about online assessments, but they can be achieved with technological educational competencies. Contrary to this research, OECD (2020) has raised questions of academic dishonesty and unfairness among university students in unproctored distance online exams and risks of technical issues during the pandemic. Redesigning of examinations has been suggested with some adaptations to create a blend of different examination modes such as synchronous oral and written exams with questions of critical thinking and various types of objective questions. Several sets of exam questions in a randomized order with limited time can reduce the chances of cheating to some extent though it is unavoidable in online distance exams. Other modes (projects, assignments, discussion forums) of formative assessment can be applied to see the students' performance. Similarly, Wahid and Farooq (2020) also suggested some quality parameters (speaking, written and objective types of questions and continuous formative assessment) to justify the validity of online assessments. Like Wahid's and Farooq's research (2020), Khan and Khan (2019) have also investigated 41 university students' views on online assessments and found students' unwillingness to accept them because of technological incompetency, lack of individualized interaction with teachers and restrictive nature of online tests mainly depending on objective types of questions. Spivey and Mcmillan (2014) have also reported that online assessments are not up to the mark of academic superiority, but they are of convenience. Their research suggests that online assessments should be synchronized and invigilated on campus. Betlej (2013) and Spivey and Mcmillan (2014) have favored the randomization of test questions with

multiple attempts and feedback. Amendola and Miceli (2018) have worked on the peer assessment to increase the efficacy of online assessment that may be a useful tool to introduce students with the dynamics of online collaborative assessment. Their study finds a significant correlation of peer assessment with the grades assigned by teachers.

The research about online classes and assessments has many prospects such as adequate application of online teaching, yet no research to the date has tried to explore specifically the experiences and opinions of university students and teachers on online classes and assessments together from five different countries.

1.2 Significance of the Study

The researchers have observed that their students and colleagues encounter many issues while conducting online classes and exams. To add or modify some online teaching and assessment strategies to overcome those problems, they have tried to collect the university students' and teachers' experiences and opinions about remote classes and assessments. Based on their experiences and opinions, changes can be made by the curriculum designers, university administrators, teachers and students to avoid those reported problems and obstacles. As a result, online classes and testing can be run successfully without hurdles like less attendance, concentration, engagement, plagiarism and technical issues.

1.3 Objectives of the Study

The study mainly aims to investigate

1. experiences and opinions of students and teachers towards online learning and assessment,
2. whether there is a relationship between students' and teachers' experiences and opinions about online classes and assessments or not, and
3. whether there is a relationship in the experiences and opinions of students and teachers of five countries: Saudi Arabia, India, Turkey, England and Canada or not.

2. Materials and Methods

2.1 Participants

The study intended to find out students' and teachers' experiences and opinions on online teaching and assessment. To do this, the questionnaires were distributed to around 300 participants, but 150 responses were collected from 90 students and 60 teachers. The participants were randomly selected from Saudi Arabia, India, Turkey, England and Canada. Participants were categorized according to their countries into five groups. The first and second groups from Saudi Arabia and India, each had 30 students and 15 teachers, third, fourth and fifth groups had 10

students and 10 teachers from each country; Turkey, England and Canada. See Table 1 below for the details.

Country	Students	Teachers	Total
Saudi Arabia	30	15	45
India	30	15	45
Turkey	10	10	20
England	10	10	20
Canada	10	10	20

Table 1-The numbers of participants country-wise.

All subjects were from universities (higher education). The student participants were undergraduate students. All teacher participants had 5 to 25 years of teaching experience at the university level. Many of them were already using online teaching as full, blended, or facilitative teaching, but some teachers never used online teaching before the COVID-19 period and the same was the case of student participants. The age of all student participants varied from 18 to 25 years. The participants were from heterogeneous linguistic and cultural groups. Moreover, they were from various faculties; Arts and Humanities, Science, Life Science, Medicine, Information and Technology, Law, etc.

2.2 Instruments and Data Collection Procedure

Two sets of questionnaires; one for students and one for teachers were composed in the Google Forms comprising 17 variables on a five-point Likert scale, ranging from '1=strongly disagree', '2=disagree', '3=neither agree nor disagree', '4=agree' to '5=strongly agree'. Both the questionnaires were divided into three parts, part 1 collected the demographic (nominal) data such as country, age and teaching experience, part 2 (items 1-8) gathered students and teachers' ordinal data (agreement or disagreement) about online learning on a five-point Likert scale and part 3 (items 9-17) elicited students and teachers' ordinal data (agreement or disagreement) about online assessment on a five-point scale.

To collect the data, the researchers distributed the questionnaires by sharing the link to their colleagues working in Saudi Arabia (Abha and Taif) and India (Kashmir and Aligarh). For the other three countries, their friends and colleagues working in the universities of Turkey (Ankara and Izmir), England (Liverpool and London) and Canada (Oshawa) helped them collect data by distributing the questionnaire among their students and colleagues.

2.3 Data Analysis

The collected data were coded for statistical analysis. To analyze the data statistically, SPSS (Statistical Package for the Social Sciences)-version 26.0 was used. First, descriptive statistics were employed to tabulate means and standard deviations. Then a series of independent samples t-tests were run to obtain the

significance value and to find out the significant relationship between students' and teachers' experiences and opinions about online learning and assessment. After that, One-way ANOVA tests were applied to compare the significant relationship among all five groups of students and teachers as well.

3. Results

3.1 Students' Experiences and Opinions about Online Classes and Assessments

Table 2 below illustrates mean scores and standard deviations regarding students' experiences and opinions about online classes and assessments.

During the COVID-19 period, students had to adapt online learning as they had no option left, but their experiences and opinions about online classes and assessments were almost negative because their responses to most items were in disagreement as most of the responses ranged from 'strongly disagree' to 'neither agree nor disagree'. There were a few positive responses. They expressed their disagreement by scoring less than 3 points on a 5-point Likert scale in these variables numbered 4 (M= 1.71, S. D= 1.22), 5 (M= 2.77, S. D= 1.24), 6 (M= 2.33, S. D= 1.43), 11 (M= 1.49, S. D=1.12), 13 (M= 1.79, S. D= 1.48), 14 (M= 1.26, S. D= .815), 16 (M= 2.03, S. D= 1.67). The participants showed neither agreement nor disagreement for the following variables numbered 1 (M= 3.31, S. D= 1.73), 2 (M= 3.48, S. D= 1.60), 7 (M=3.63, S. D= 1.50), 8 (M= 3.74, S. D= 1.23), 9 (M=3.86, S. D= 1.50), 10 (M= 3.93, S. D= 1.65) by scoring more than 2 points and less than 4 points. They scored higher than 4 points only for 4 variables numbered 3 (M= 4.71, S. D= .864), 12 (M= 4.47, S. D= 1.21), 15 (M= 4.14, S. D= 1.55), 17 (M=4.41, S. D= .947) to express their agreement. For the variables 7 and 8, students felt satisfaction in terms of only having online classes because they think that at least, they had the availability of digital classes rather than the complete shutdown of classes. However, they did not discover them equivalent in quality of face-to-face on campus classes.

Variables	Mean	Std. Deviation
Online Classes		
1. I enjoy online classes like traditional classes.	3.31	1.73
2. Virtual classes open the doors to innovations more broadly.	3.48	1.60
3. I am well-trained how to use different types of online platforms.	4.71	.864
4. I understand better in virtual classes than in face-to-face classes.	1.71	1.22
5. I never face any technical problems in attending online classes.	2.77	1.24
6. Online classes are effective and high-quality learning platforms as face-to-face classes.	2.33	1.43
7. I feel as satisfied with online lectures as traditional lectures.	3.63	1.50
8. My experience of attending online classes was great.	3.74	1.23
Online Assessments		
9. Online tests are valid tools or alternatives to pen and paper exams.	3.86	1.50
10. I never face any technical problems in doing online exams.	3.93	1.65
11. Asynchronous assessment is a valid tool to examine students' progress and performance.	1.49	1.12
12. Synchronous assessment is a valid tool to examine students' progress and performance.	4.47	1.21
13. Synchronous subjective (written) test is the best type of test for the online assessment.	1.79	1.48
14. Synchronous speaking test is the best type of test for the online assessment.	1.26	.815
15. Synchronous objective exam is the best type of test for the online assessment.	4.14	1.55
16. Synchronous objective, subjective followed by a speaking test is the best type of test for the online assessment.	2.03	1.67
17. My performance in online exams was excellent.	4.41	.947

Table 2 - Students' experiences and opinions about online classes and assessments.

3.2 Teachers' Experiences and Opinions about Online Classes and Assessments

Table 3 below presents mean scores and standard deviations of teachers' experiences and opinions about online classes and assessments.

The findings in Table 3 are not very different from those of Table 2 though they chose disagreement options more than students. Teachers also asserted that online classes and assessments were not up to the mark or highly appreciated because online teaching does not meet the quality of face-to-face teaching and especially online assessment. From the results, it can be said that it was a forced shift to online teaching just to cope with the pandemic situation. Their responses noticeably tended to be negative. The range of their responses mostly varied from 'strongly disagree' to 'neither agree nor disagree'. Only a few responses were in agreement. They showed their disagreement in these variables numbered 4 (M= 1.33, S. D= 1.11), 5 (M= 2.70, S. D= 1.32), 6 (M= 2.30, S. D= 1.24), 7 (M= 2.37, S. D=1.66), 9 (M= 2.43, S. D= 1.38), 10 (M= 2.63, S. D= 1.31), 11 (M= 1.15, S. D= .481), 13 (M= 2.07, S.D= 1.70), 14 (M=1.33, S. D= 1.11) by scoring lower than 3 points on a 5-point Likert scale. The teachers indicated neither agreement nor disagreement for these variables numbered 1 (M= 3.30, S. D= 1.63), 2 (M= 3.37, S. D= 1.61), 15 (M=3.73, S. D= 1.68), 17 (M= 3.90, S. D= 1.10) because they scored more than 2 points and less than 4 points. Like students, to express their agreement, they had higher than 4 points only for 4 variables numbered 3 (M= 4.77, S. D= .767), 8 (M= 4.00, S. D= 1.04), 12 (M= 4.85, S. D= .481), 16 (M= 4.47, S. D= 1.17).

3.3 Difference in Experiences and Opinions about Online Classes and Assessments between Students and Teachers

Table 4 below illustrates the difference in experiences and opinions between students and teachers about online classes and assessments. For this purpose, independent samples t-tests were performed and the mean scores of students' experiences and opinions about online classes and assessments were compared with teachers' experiences and opinions about online classes and assessments.

The first 8 variables are about online classes in Table 4, and the 9 items are for online assessments starting from 9 to 17. The results of the t-test for equality of means did not reveal a significant difference between students and teachers regarding online classes because the significance value is > 0.05 . Only variable no.7 has a difference as its significance value is $p < .000$ which is < 0.05 .

Variables	Mean	Std. Deviation
Online Classes		
1. I enjoy conducting online classes like traditional classes.	3.30	1.63
2. Virtual classes open the doors to innovations more broadly.	3.37	1.61
3. I know very well how to use different types of online platforms.	4.77	.767
4. My students understand better in virtual classes than in face-to-face classes.	1.33	1.11
5. I never face any technical problems in conducting online classes.	2.70	1.32
6. Online classes are effective and high-quality learning platforms as face-to-face classes.	2.30	1.24
7. I feel as satisfied with online lectures as traditional lectures.	2.37	1.66
8. My experience of conducting online classes was great.	4.00	1.04
Online Assessments		
9. Online tests are valid tools or alternatives to pen and paper exams.	2.43	1.38
10. I never face any technical problems in conducting online tests.	2.63	1.31
11. Asynchronous assessment is a valid tool to examine students' progress and performance.	1.15	.481
12. Synchronous assessment is a valid tool to examine students' progress and performance.	4.85	.481
13. Synchronous subjective (written) test is the best type of test for online assessment.	2.07	1.70
14. Synchronous speaking test is the best type of test for online assessment.	1.33	1.11
15. Synchronous objective exam is the best type of test for online assessment.	3.73	1.68
16. Synchronous objective, subjective followed by a speaking test is the best type of test for online assessment.	4.47	1.17
17. My students' performance in online exams was excellent.	3.90	1.10

Table 3 - Teachers' experiences and opinions about online classes and assessments.

Item numbered 7 asked their agreement or disagreement about their satisfaction, *I feel as satisfied with online lectures as traditional lectures*. Here, teachers disagreed more than students. Perhaps the reason would be teachers' overload of preparing content and material for online classes and to give extra efforts to make online lectures interactive while students often did not attend the lectures until there was the marking of attendance.

However, regarding online assessment, there is a significant difference in experiences and opinions between both the groups. From variable numbered 9 to 17, Table 4 has items about online assessment, most of the items revealed a significant difference. It might be because teachers expressed eagerness in the validity proved exams by applying different online assessment tools. On the other hand, students agreed on the easy-way options for online testing to avoid any mishap. The significance value of items numbered 9, 10, 11, 12, 16, 17 was <0.05. While 3 variables (13, 14, 15) revealed non-significant p-value (>0.05) indicating no difference.

t-test for equality of means			
Online Classes		Online Assessments	
Variables	P	Variables	P
1.	.969*	9.	.000
2.	.6798	10.	.000
3.	.687*	11.	.012
4.	.118	12.	.008
5.	.753*	13.	.290*
6.	.883*	14.	.644*
7.	.000	15.	.133*
8.	.188*	16.	.000
		17.	.003

Table 4 - One-way ANOVA for students' experiences and opinions about online classes and assessments with respect to country.

3.4 Country-wise Students' Experiences and Opinions about Online Classes and Assessments

To examine whether there was a significant difference or not according to country wise, the mean scores of students from five countries (Saudi Arabia, India, Turkey, England, and Canada) were compared in Table 5 below by applying the one-way ANOVA tests.

The findings of the ANOVA tests revealed that there was no such a significant difference among five groups of students according to countries. 9 items did not display any difference in experiences and opinions about online learning and testing among countries. They share non-significant difference (>0.05) as in these variables numbered 1 (F= .446, p= .775), 3 (F= .735, p= .571), 5 (F= 2.449, p= .052), 6 (F= 1.402, p= .240), 8 (F= 1.617, p= .177), 9 (F= 2.203, p= .075), 11 (F= 1.021, p= .401), 12 (F= .649, p= .629), 14 (F= .701, p= .593). While 8 variables showed significant difference (<0.05). They are as follows numbered 2 (F= 3.464, p= .011), 4 (F= 4.469, p= .003), 7 (F= 5.971, p= .000), 10 (F= 6.342, p= .000), 13 (F= 3.205, p= .017), 15 (F= 4.255, p= .003), 16 (F= 2.773, p= .032), 17 (F= 2.960, p= .024).

Furthermore, to exhibit the multiple comparisons of variables with a significant difference among all five countries very clearly, post hoc tests (Scheffe test) were done (See Appendix 1). These post hoc tests indicated that Turkish and British students did not consider an online classroom setting as innovative as a face-to-face classroom setting. They disagreed with this variable 2 more than Saudi, Indian and Canadian students. The mean scores (2.20, 2.80) and standard deviations (1.38, 1.55) of Turkish and British students' responses respectively were lower than Saudi (3.97, 1.50), Indian (3.77, 1.61) and Canadian (3.10, 1.45) students' responses.

Online Classes			Online Assessments		
Items	F ANOVA	P	Items	F ANOVA	P
1.	.446	.775	9.	2.203	.075
2.	3.464	.011	10.	6.342	.000
3.	.735	.571	11.	1.021	.401
4.	4.469	.003	12.	.649	.629
5.	2.449	.052	13.	3.205	.017
6.	1.402	.240	14.	.701	.593
7.	5.971	.000	15.	4.255	.003
8.	1.617	.177	16.	2.773	.032
			17.	2.960	.024

Table 5 - Difference in experiences and opinions about online classes and assessments between students and teachers.

For item numbered 4, Indian and Turkish students were of the view that online classes do not share the same quality of learning as offline classes more than other groups. As their scores (M= 1.27, S. D= .450) of Indian

students and (M= 1.00, S. D= .000) of Turkish students were lower than the other three groups. Then another significant difference was seen in variable numbered 7. Indian students expressed more satisfaction in attending online classes (M=4.37, S. D= 1.03) than the students of the other four countries, for example, Saudi (M= 3.83, 1.51), Turkey (M= 2.90, 1.45), England (M= 2.60, 1.51) and Canada (M= 2.60, 1.51). The reason might be in India, online classes were not started immediately after the lock-down (March 21, 2020). The classes were suspended for a long time so the students felt satisfied when the online classes started while in other countries, online classes came into effect immediately. Further, Indian (M= 2.40, S. D= 1.43) and Turkish (M= 2.80, S. D= 1.93) students faced more technical problems than other groups (Saudi Arabia, M= 3.90, S. D.= 1.73), (England, M= 4.60, S. D= 1.26) and (Canada, M= 4.63, S. D= 1.07) in doing online exams due to many factors like in Kashmir, India, students had only unstable 2 GB Internet speed and in Turkey, students might have problems because of the high rates of Internet and control of the government over social-media platforms. The next variable that had a significant difference in the groups was 13. Saudi and Indian students expressed their disagreement greater than the other three countries, the scores were M= 1.37, S. D= 1.23 (Saudi Arabia), M= 1.47, S. D= 1.14 (India), M= 2.70, S. D= 2.00 (Turkey), M= 2.50, S.D= 1.78 (Britain) and M= 2.40, S.D= 1.84 (Canada). While Saudi (M= 4.53, S. D= 1.22) and Indian students (M= 4.63, S. D= 1.13) preferred objective type of online exams more than other students of Turkey (M= 3.40, S. D= 1.90), Britain (M= 3.00, S. D= 1.76) and Canada (M= 3.40, S. D= 2.07). Again, for variable numbered 16, Indian and Saudi students were in less favor of using different assessment tools combinedly than Turkish, British and Canadian students. The mean scores and standard deviations of Saudi, Indian, Turkish, British, Canadian students were 1.30 (1.02), 2.13 (1.72), 2.60 (2.07), 2.80 (1.75), 2.60 (2.07) as shown in Table 5 above. Then for the last variable numbered 17, Saudi (M= 4.53, S. D= .766) and Indian (M= 4.73, S.D= .640) students felt more satisfied towards their performance in online assessment than Turkish (M= 4.10, S. D= 1.10), British (M= 3.90, S. D= 1.45) and Canadian students (M= 3.90, S. D= 1.10).

3.5 Country-wise Teachers’ Experiences and Opinions about Online Classes and Assessments

Likewise, students’ data analysis, teachers’ data was also compared by using one-way ANOVA tests to investigate whether there was a significant difference or not according to countries illustrated in Table 6.

The findings of the ANOVA tests indicated that there was not a significant difference among five groups of students according to countries in Table 6. 15 out of 17 variables marked no significant difference such as 1 (F= 1.649, p= .175), 2 (F= .658, p= .624), 3 (F= 1.706,

p= .162), 4 (F= 1.497, p= .267), 5 (F= 1.110, p= .361), 6 (F= 1.229, p= .309), 7 (F= .313, p= .868), 8 (F= 1.081, p= .375), 11 (F= 2.250, p= .076), 12 (F= .651, p= .629), 13 (F= 1.243, p= .304), 14 (F= 1.497, p= .216), 15 (F= 1.777, p= .147), 16 (F= 1.384, p= .252), 17 (F= .780, p= .543). Very less difference was found (p=<0.05) only in two variables numbered 9 (F= 3.18, p= .020), 10 (F= 2.83, p= .033). Additionally, post hoc tests (Scheffe test) were performed to make multiple comparisons among all five countries (See Appendix 2).

Online Classes			Online Assessments		
Items	F ANOVA	P	Items	F ANOVA	P
1.	1.649	.175	9.	3.178	.020
2.	.658	.624	10.	2.830	.033
3.	1.706	.162	11.	2.250	.076
4.	1.497	.267	12.	.651	.629
5.	1.110	.361	13.	1.243	.304
6.	1.229	.309	14.	1.497	.216
7.	.313	.868	15.	1.777	.147
8.	1.081	.375	16.	1.384	.252
			17.	.780	.543

Table 6 - One-way ANOVA for teachers’ experiences and opinions about online classes and assessments with respect to country.

Again, Indian teachers did not see online exams as valid as face-to-face assessments because their universities were lagging behind in the use of technology in classrooms. Till the coronavirus period, Indian teachers were generally using the only traditional way of teaching without any blended or facilitated practice of e-learning with some exceptions. If e-learning pedagogies were growing at a very slow pace (Nehal & Khan, 2020). Therefore, Indian teachers had to make a sudden shift to full online teaching. Variable 9 presented this difference among five groups through these mean scores and standard deviations in parenthesis such as Saudi Arabia, 3.27 (1.71), India, 1.73 (1.03), Turkey, 2.00 (1.15), Britain, 2.30 (.949) and Canada, 2.80 (1.32). Furthermore, Indian teachers for item number 10 (M= 1.80, S. D= .422) revealed their negative response towards technical problems while conducting online exams more bluntly than teachers of other countries Saudi Arabia (M=2.80, S. D= 1.37), Turkey (M= 2.40, S. D= 1.17), Britain (M= 3.60, S. D= 1.43) and Canada (M= 2.53, S. D= 1.36). It might be predicted that in Kashmir, teachers did not have high speed and stable internet connection. However, teachers from other countries faced this problem less than Indian teachers.

4. Discussion and Conclusions

In general, the results depicted that students and teachers were not inclined towards the use of online learning and especially online assessment. They considered that online teaching can never be a substitute to face-to-face learning. Face-to-face on campus classrooms are highly interactive and students come to the classes for the learning purpose only. They do not get distracted by other things unlike online classes where they can remain busy in other things if the online class is not engaging the students. Despite their opinion, they had to take online classes just to cope up with the unprecedented present situation of the pandemic. Classes were taken the same way as in the institutions. The only difference was that of home and the institution. The timetable was followed both by students and the teachers, but more or less they were both overburdened throughout the semester. Sometimes, their digital gadgets/tools were congested and got hanged. In spite of all these obstacles, they had to continue out of necessity. The present study found that both the teachers and students were not satisfied with their experience of online pedagogy. There was no significant difference between their experiences and opinions towards online learning. There might be several factors behind it. The researchers tried to focus on these factors or issues with implications.

Both the teachers and the students across the five countries were enthusiastic at the beginning of the online classes but towards the end of semester, this enthusiasm started decreasing and both teachers and the students began feeling tired, bored because there was no time for social proximity and recreation. They remained all-time busy with eLearning, home-work, assignments, exams, and so on. In fact, teachers were found overburdened more than students as they had to put extra efforts to create e-content for online teaching and additionally, they had to look for a suitable online platform (Allen, Rowan & Singh, 2020) especially countries like India where teachers did not have instructional eLearning platform. In other countries, like Saudi Arabia, Turkey, Canada, England, teachers had already established eLearning platforms that assisted them a lot, but still, they had to prepare teaching materials and contents because previously, they were teaching through either full, blended or facilitative mode of online teaching. These modes helped them teach and they had also social interaction and face-to-face classes on campus. Therefore, it is recommended that the countries can learn from one another in redeveloping their own learning management systems (LMS) and restructuring e-contents and e-curricula to meet any unprecedented situation (Crawford *et al.*, 2020) or even in a normal situation, it would facilitate learning. Teachers who were using online content from different websites had difficulty covering the course plan accurately so,

sometimes there was a mismatch between course plan and student learning (Bao, 2020). The study material was made by teachers and sent to students every day and they had to deliver lectures and finish courses on time. This procedure is very hard to follow for teachers. Hence, there is a need to redevelop curricula. To make online learning successful, institutions, teachers and students should work collectively. Without adequate institutional support, online pedagogy becomes quite difficult for both the students and teachers.

Effective and flexible online classes are the keys to overcome the challenges of online teaching posed by COVID-19 (Huang *et al.*, 2020). It is possible when online classes are highly interactive and interesting. Teachers keep their students engaged in discussions and interactions through various teaching strategies and at the same time, they convey information successfully and cover their course objectives to meet the outcomes (Bao, 2020). Furthermore, teachers should not apply their traditional teaching style in online pedagogy. Teachers cannot know whether their classes were taken seriously without interactive teaching sessions (Jan, 2020, Ertmer *et al.*, 2011; Devitt *et al.*, 2020). To improve the virtual teaching, reflective teaching strategies also must be added to online sessions, it would help both the students and teachers to understand the barriers of successful conveyance of online learning (Kolb, 1984; Hasper, 2020) and to evolve for the new setting of pedagogy.

Continuous professional development is another key to face the challenges of online teaching during the coronavirus period. To teach online, teachers and students must be very good at using various online platforms and tools for successful conveyance of information (Devitt *et al.*, 2020). It is the responsibility of institutions, teachers and students to update them according to the new trends of technology and effective pedagogical approaches. If any of them would not be efficient and skilled enough especially teachers, online learning may be a complete failure (Frazer *et al.*, 2017). Though in this research, teachers and students exhibited that they were aware enough to use different online learning platforms.

Another factor that affects online teaching is the unstable Internet connection, its speed and the use of outdated devices and software. Governments and Institutions must provide quick IT infrastructure to its colleges, teachers and students because it was found in some places like Kashmir teachers and students suffered from 2 GB Internet connection. Therefore, stable Internet connection with high speed and advanced versions of the software are required for online teaching in those places where they lacked it like India (Agarwal & Kaushik, 2020). Though the Indian government also launched Swayam program to assist online teaching. Still, there is more need to develop fast institutional eLearning platforms and contingency plans.

This study also implies there must be some kind of financial help for the needy students by distributing them laptops or other gadgets that suit their needs because it was seen by the researchers in India. Sometimes, their students were not able to connect because of low connectivity. There were also students who could not afford digital devices or Internet facilities, so they also had to suffer.

The second focus of this study is the online assessment. For this section, university teachers and students across the countries have not experienced online exams as fair as on-campus exams because it is very easy for students to cheat no matter whatever precautions teachers take. According to them, remote online assessment can never be a replacement to pen-paper or online assessment on the campus. The study found that both the students and teachers favored synchronous (at one time) online exams. Teachers opined online assessment can never be fair without proctored or invigilated exams. Synchronous exams, formative and continuous assessments, time-limit with a mixed approach of creating exams: objective, subjective, extempore writing and speaking are some tips to maintain and justify the validity of online testing (Khan & Khan, 2019).

The study found that both the students and teachers favored synchronous (at one time) online exams (Devitt *et al.*, 2020). They did not consider asynchronous (at different times) online exams valid to examine student performance. Though students were seen to favor objective exams because it was the easiest option for them. However, for teachers, multiple-choice online exams were hard to know how much fair students were in their test. Teachers claimed that online assessment must be a mixed way of objective, subjective questions followed by a speaking exam to discuss students' understanding of the subject. There was a highly significant difference between students and teachers' opinion about mixed tools and only multiple-choice questions. Furthermore, regarding students' performance in online assessment, there was again a substantial difference. Students felt highly satisfied with their performance while teachers were not satisfied to that extent. Teachers viewed that online assessment can never be fair without proctored or invigilated exams.

Based on the findings, this research offered some implications to improve the quality and validity indicators of online assessment (Frazer *et al.*, 2017). First and foremost, online exams should be synchronous that includes various types of questions. Second, different sets of exams through random blocks should be prepared to assess the students fairly. Then any type of exam can be assessed further by a speaking exam or a discussion about the exam. Next, teachers should observe their students' active participation in online sessions for the justification of online assessment. Synchronous virtual pedagogy is required

to observe the students' progress throughout the online sessions. Asynchronous teaching and assessment should be avoided. It can be used in case of an emergency, technical problems or giving additional assignments and activities.

The next implication of the research is that teachers must maintain the time limit of online exams. For example, synchronous exams should be completed within the same timing as on-campus exams and asynchronous online exams should have also a time limit of attempting and a deadline for the closure of tests. Students should not be provided many attempts of one test.

This study further implies that continuous assessment through various tools is recommended. Through continuous assessment, teachers might be able to justify the quality of their students' performance in online exams. This work also suggests alternative assessment can be employed to assess the students continuously such as peer assessment (Amendola & Miceli, 2018) project writing, poster making and peer discussion over given topics related to the course. Universal design should be followed (Dickinson & Gronseth, 2020). These topics can be extempore or assigned earlier.

Institutional support is again very necessary for both teachers and students. CPD (Continuous Professional Development) programs about online assessment tools and software are required for both teachers and students. Institutes should organize CPD programs about fair online assessments and give free access to important software of fair assessments like Turnitin, Grammarly, etc. Though the countries which have their own LMS such as blackboard, provide safe-assign option to avoid plagiarism. Blended learning/digital technology should be implied in the post coronavirus period for a better future prospect (Li & Lalani, 2020; Minerva, 2020).

The study focused on teachers' and students' experiences and opinions about online teaching and assessment. It was found that both of them did not agree that online teaching or assessment can meet the quality of face-to-face teaching and on-campus assessment. Still, online teaching is the undeniable need of the hour to deal with unprecedented situations like the COVID-19 pandemic. It can be deployed as an effective tool to enhance and facilitate face-to-face teaching during normal situations. Online teaching in the form of full or blended is an integral and inseparable part of higher education pedagogy in the present and future. It has many benefits to improve the monotonous teaching approaches by making them exciting and interactive. To achieve the targeted outcomes of online sessions, efficient teachers and effective interactive and reflective teaching approaches are required to engage students and reflect upon the information conveyance with institutional support financially, socially and professionally.

This research is limited to university students and teachers in general from five countries. Further studies may explore more about other specific elements or areas of online learning and assessments through LMS. Additionally, the research has limited instruments like questionnaires, so in the future, other instruments, i.e., a combination of questionnaires and interviews, may be used to collect more data to contribute specific conclusions related to online classes and assessments.

Acknowledgements

The first author extends her appreciation to the Deanship of Scientific Research, King Khalid University for funding this work through a research program under grant number R.G.P. 1/146/42.

References

- Agarwal, S. & Kaushik, J. S. (2020). Students' perception of online learning during COVID pandemic. *Indian Journal of Pediatrics*, 87 (7), 554. <https://doi.org/10.1007/s12098-020-03327-7>
- Allen, J., Rowan, L. & Singh, P. (2020) Teaching and teacher education in the time of COVID-19. *Asia-Pacific Journal of Teacher Education*, 48 (3), 233-236. <https://doi.org/10.1080/1359866X.2020.1752051>
- Amendola, D. & Miceli, C. (2018). Online peer assessment to improve students' learning outcomes and soft skills. *Italian Journal of Educational Technology*, 26(3),71-84. <https://doi.org/10.17471/2499-4324/1009>
- Bao, W. (2020). COVID-19 and online teaching in higher education: A case study of Peking University. *Human Behavior and Emerging Technologies*, 2 (2), 113-115. <https://doi.org/10.1002/hbe.19>
- Betlej, P. (2013). E-examinations from student's perspective-The future of knowledge evaluation. *Studia Ekonomiczne*, 152, 9–22.
- Carter, L. M., Salyers, V. Myers, S. et al. (2014). Qualitative insights from a Canadian multi-institutional research study: in search of meaningful e-learning. *The Canadian Journal for the Scholarship of Teaching and Learning*, 5 (1), 1-21.
- Crawford, J., Butler-Henderson, K. Rudolph, J. & Lam, S. (2020). COVID-19: 20 countries' higher education intra period digital pedagogy responses. *Journal of Applied Learning and Teaching*, 3 (1), 9-28. <http://journals.sfu.ca/jalt/index.php/jalt/>
- Devitt, A., Bray, A. Banks, J & Chorcora, E. N. (2020). Teaching and learning practices during school closures: lessons learned: Irish second-level teacher perspectives. <https://www.tcd.ie/Education/>
- Dickinson, K. J. & Gronseth, S. L. (2020). Application of Universal Design for Learning (UDL) principles to surgical education during the COVID -19 pandemic. *Journal of Surgical Education (In Press)*. <https://doi.org/10.1016/j.jsurg.2020.06.005>
- Ertmer, P. A. Sadaf, A. & Ertmer, D. J. (2011). Student-content interactions in online courses: the role of question prompts in facilitating higher-level engagement with course content. *Journal of Computing in Higher Education*, 23 (2-3), 157-186.
- Elzainy, A., El Sadik, A & Al Abdulmonem, W. (2020). Experience of e-learning and online assessment during the COVID-19 pandemic at the College of Medicine, Qassim University. *Journal of Taibah University Medical Sciences*, 15(6), 456-462. <https://doi.org/10.1016/j.jtumed.2020.09.005>
- Frazer, C., Sullivan, D. H., Weatherspoon, D. & Hussey, L. (2017). Faculty perception of online teaching effectiveness and indicators of quality. *Nursing Research and Practice*, 10,1-6. <https://doi.org/10.1155/2017/9374189>
- Halim, S., Wahid, R. & Halim, T. (2018). Classroom observation- a powerful toll for continuous professional development (CPD). *International Journal of Language, Research and Education Studies*, 2 (2), 162-168. <http://jurnal.uinsu.ac.id/index.php/ijlres>
- Hasper, A. (2020). Professional development: Reflecting in times of covid-19: Keep calm and keep GROW-ing. <https://www.cambridge.org/elt/blog/2020/06/07/reflecting-in-times-of-covid-19-keep-calm-and-keep-grow-ing/>
- Huang, R. H., Liu, D. J., Tlili, A., Yang, J. F., & Wang, H. (2020). Handbook on facilitating flexible learning during educational disruption: The Chinese experience in maintaining uninterrupted learning in COVID-19 outbreak. <https://iite.unesco.org/wpcontent/uploads/2020/03/Handbook-on-Facilitating-Flexible-Learning-in-COVID-19>
- Jan, A. (2020). Online teaching practices during COVID-19: An observation case study. Preprint. Available at <https://ssrn.com/abstract=3584409>
- Khan, S. & Khan, R.A. (2019). Online assessments: Exploring perspectives of university students.

- Education and Information Technologies, 24, 661-677. <https://doi.org/10.1007/s10639018-9797-0>
- Kolb, D.A. (1984). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.
- Li, C. & Lalani, F. (2020). The COVID-19 pandemic has changed the education forever: This is how. <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19->
- Minerva, T. (2020). Educational dinosaurs in the digital-pandemic era: the need for a digital framework and an emergency framework in education [Editorial]. *Journal of e-Learning and Knowledge Society*, 16 (3) I-III. <https://doi.org/10.20368/19718829/1135348>
- Nehal, R & Khan, W. A. (2020, 11 June). Teaching with the technology: solution or sacrifice. TwoCircles.net: Mainstream News of the Marginalized. <http://twocircles.net/2020june11/43743>
- OECD (2020). Remote online exams in higher education during the COVID-19 crisis. *Education Policy Perspectives*, 6. <https://doi.org/10.1787/f53e2177-en>
- Raman, P. (2020). Your first class on Zoom. OISE Online. <https://wordpress.oise.utoronto.ca/teachingonline/2020/05/03/8326/>
- Richardson, J. C., Besser, E., Koehler, A, Lim, J. & Strait, M. (2016). Instructors' perceptions of instructor presence in online learning environments. *The International Review of Research in Open and Distributed Learning*, 17 (4), 82-104.
- Richardson, S. & Diaz Maggioli, G. (2018). Effective professional development: Principles and best practice: Part of the Cambridge papers in ELT. https://www.cambridge.org/elt/blog/wp-content/uploads/2018/04/Whitepaper_TD_7_2dpi-FINAL-ONLINE-VERSION.pdf
- Schon, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Spivey, M. F., & Mcmillan, J. J. (2014). Classroom versus online assessment. *Journal of Education for Business*, 89, 450–456. <https://doi.org/10.1080/08832323.2014.937676>
- The World Bank (2020). Remote learning, EdTech & COVID-19. <https://www.worldbank.org/en/topic/edutech/brief/edtech-covid-19>
- UNESCO (2020, 13 March). COVID-19 educational disruption and response. <https://en.unesco.org/covid19/educationresponse>.
- WHO (2020, 11 March). World Health Organization announces Covid-19 outbreak a pandemic. <http://www.euro.who.int/en/health-topics>
- Wahid, R. & Farooq, O. (2020). Online exams in the time of COVID-19: Quality parameters. *International Journal of Social Sciences and Educational Studies*, 7 (4), 13-21. <http://dx.doi.org/10.23918/ijsses.v7i4p13>

Research Materials

Appendix 1

<i>Table 2 with frequencies, mean scores and standard deviations</i>				
<i>Students' experience and opinion about online classes and assessments</i>				
Variables	Minimum	Maximum	Mean	Std. Deviation
Online Classes				
1. I enjoy online classes like traditional classes.	1	5	3.31	1.73
2. Virtual classes open the doors to innovations more broadly.	1	5	3.48	1.60
3. I know very well how to use different types of online platforms.	2	5	4.71	.864
4. I understand better in virtual classes than in face-to-face classes.	1	5	1.71	1.22
5. I never face any technical problems in attending online classes.	1	5	2.77	1.24
6. Online classes are effective and high-quality learning platforms as face-to-face classes.	1	5	2.33	1.43
7. I feel as satisfied with online lectures as traditional lectures.	1	5	3.63	1.50
8. My experience of attending online classes was great.	1	5	3.74	1.23
Online Assessments				
9. Online tests are valid tools or alternatives to pen and paper exams.	1	5	3.86	1.50
10. I never face any technical problems in doing online exams.	1	5	3.93	1.65
11. Asynchronous assessment is a valid tool to examine students' progress and performance.	1	5	1.49	1.12
12. Synchronous assessment is a valid tool to examine students' progress and performance.	1	5	4.47	1.21
13. Synchronous subjective (written) test is the best type of test for the online assessment.	1	5	1.79	1.48
14. Synchronous speaking test is the best type of test for the online assessment.	1	5	1.26	.815
15. Synchronous objective exam is the best type of test for the online assessment.	1	5	4.14	1.55
16. Synchronous objective, subjective followed by a speaking test is the best type of test for the online assessment.	1	5	2.03	1.67
17. My performance in online exams was excellent.	1	5	4.41	.947

(1= strongly disagree to 5= strongly agree)

Appendix 2

Table 3 with frequencies, mean scores and standard deviations
Teachers' experience and opinion about online classes and assessments

Variables	Minimum	Maximum	Mean	Std. Deviation
Online Classes				
1. I enjoy conducting online classes like traditional classes.	1	5	3.30	1.63
2. Virtual classes open the doors to innovations more broadly.	1	5	3.37	1.61
3. I know very well how to use different types of online platforms.	2	5	4.77	.767
4. My students understand better in virtual classes than in face-to-face classes.	1	5	1.33	1.11
5. I never face any technical problems in conducting online classes.	1	5	2.70	1.32
6. Online classes are effective and high-quality learning platforms as face-to-face classes.	1	5	2.30	1.24
7. I feel as satisfied with online lectures as traditional lectures.	1	5	2.37	1.66
8. My experience of conducting online classes was great.	1	5	4.00	1.04
Online Assessments				
9. Online tests are valid tools or alternatives to pen and paper exams.	1	5	2.43	1.38
10. I never face any technical problems in conducting online tests.	1	5	2.63	1.31
11. Asynchronous assessment is a valid tool to examine students' progress and performance.	1	5	1.15	.481
12. Synchronous assessment is a valid tool to examine students' progress and performance.	1	5	4.85	.481
13. Synchronous subjective (written) test is the best type of test for online assessment.	1	5	2.07	1.70
14. Synchronous speaking test is the best type of test for online assessment.	1	5	1.33	1.11
15. Synchronous objective exam is the best type of test for online assessment.	1	5	3.73	1.68
16. Synchronous objective, subjective followed by a speaking test is the best type of test for online assessment.	1	5	4.47	1.17
17. My students' performance in online exams was excellent.	1	5	3.90	1.10

(1= strongly disagree to 5= strongly agree)

Appendix 3

*Table 4 with mean scores and standard deviations
 Difference in experiences and opinions about online classes and assessments between students and teachers*

<i>t-test for equality of means</i>						
Items	Groups	N	Mean	SD.	SEM	p
1	A (Students)	90	3.31	1.73	.183	.969*
	B (Teachers)	60	3.30	1.63	.210	
2	A (Students)	90	3.48	1.60	.169	.679*
	B (Teachers)	60	3.37	1.61	.209	
3	A (Students)	90	4.71	.864	.091	.687*
	B (Teachers)	60	4.77	.767	.099	
4	A (Students)	90	1.71	1.22	.151	.118
	B (Teachers)	60	1.33	1.11	.144	
5	A (Students)	90	2.77	1.24	.130	.753*
	B (Teachers)	60	2.70	1.32	.170	
6	A (Students)	90	2.33	1.43	.151	.883*
	B (Teachers)	60	2.30	1.24	.160	
7	A (Students)	90	3.63	1.50	.158	.000
	B (Teachers)	60	2.37	1.66	.214	
8	A (Students)	90	3.74	1.23	.130	.188*
	B (Teachers)	60	4.00	1.04	.134	
9	A (Students)	90	3.86	1.50	.158	.000
	B (Teachers)	60	2.43	1.38	.178	
10	A (Students)	90	3.93	1.65	.174	.000
	B (Teachers)	60	2.63	1.31	.170	
11	A (Students)	90	1.49	1.12	.119	.012
	B (Teachers)	60	1.15	.481	.062	
12	A (Students)	90	4.47	1.21	.128	.008
	B (Teachers)	60	4.85	.481	.062	
13	A (Students)	90	1.79	1.48	.156	.290*
	B (Teachers)	60	2.07	1.70	.219	
14	A (Students)	90	1.26	.815	.086	.644*
	B (Teachers)	60	1.33	1.11	.144	
15	A (Students)	90	4.14	1.55	.164	.133*
	B (Teachers)	60	3.73	1.68	.216	
16	A (Students)	90	2.03	1.67	.176	.000
	B (Teachers)	60	4.47	1.17	.151	
17	A (Students)	90	4.41	.947	.100	.003
	B (Teachers)	60	3.90	1.10	.142	

Appendix 4

Table 5 with mean scores and standard deviations

One-way ANOVA for students' experiences and opinions about online classes and assessment with respect to country

Items	(1) Saudi students (n=30) (Mean, S.D.)	(2) Indian students (n= 30) (Mean, S.D.)	(3) Turkish students (n=10) (Mean, S.D.)	(4) British students (n=10) (Mean, S.D.)	(5) Canadian students (n=10) (Mean, S.D.)	F (ANOVA)	P
1	3.60 (1.83)	3.20 (1.69)	2.80 (1.75)	3.30 (1.83)	3.30 (1.64)	.446	.775
2	4.13 (1.55)	4.30 (1.29)	3.00 (1.33)	3.60 (1.43)	4.00 (1.41)	1.851	.127
3	3.97 (1.50)	3.77 (1.61)	2.20 (1.38)	2.80 (1.55)	3.10 (1.45)	3.464	.011
4	4.67 (.922)	4.90 (.548)	4.70 (.949)	4.40 (1.26)	4.60 (.966)	.735	.571
5	2.30 (1.51)	1.27 (.450)	1.00 (.000)	2.10 (1.59)	1.60 (1.26)	4.469	.003
6	2.57 (1.07)	3.23 (1.22)	2.10 (1.10)	2.40 (1.43)	3.00 (1.33)	2.449	.052
7	2.77 (1.52)	2.03 (1.35)	1.80 (1.23)	2.40 (1.43)	2.40 (1.43)	1.402	.240
8	3.83 (1.51)	4.37 (1.03)	2.90 (1.45)	2.60 (1.51)	2.60 (1.51)	5.971	.000
9	3.60 (1.52)	4.13 (.776)	3.20 (1.55)	3.40 (1.17)	3.90 (.876)	1.617	.177
10	3.73 (1.66)	4.37 (1.30)	4.10 (.876)	3.10 (1.66)	3.20 (1.55)	2.203	.075
11	3.90 (1.73)	2.40 (1.43)	2.80 (1.93)	4.60 (1.26)	4.63 (1.07)	6.342	.000
12	1.73 (1.36)	1.23 (.898)	1.20 (.422)	1.60 (1.26)	1.70 (1.25)	1.021	.401
13	4.43 (1.30)	4.47 (1.22)	5.00 (.000)	4.30 (1.25)	4.20 (1.48)	.649	.629
14	1.37 (1.23)	1.47 (1.14)	2.70 (2.00)	2.50 (1.78)	2.40 (1.84)	3.205	.017
15	1.37 (1.23)	1.13 (.346)	1.40 (.516)	1.40 (1.26)	1.00 (.000)	.701	.593
16	4.53 (1.22)	4.63 (1.13)	3.40 (1.90)	3.00 (1.76)	3.40 (2.07)	4.255	.003
17	1.30 (1.02)	2.13 (1.72)	2.60 (2.07)	2.80 (1.75)	2.60 (2.07)	2.773	.032
18	4.53 (.766)	4.73 (.640)	4.10 (1.10)	3.90 (1.45)	3.90 (1.10)	2.960	.024

Appendix 5

Table 6 with mean scores and standard deviations

One-way ANOVA for teachers' experiences and opinions about online classes and assessment with respect to country

Items	(1) Saudi teachers (n=15) (Mean, S.D.)	(2) Indian teachers (n= 15) (Mean, S.D.)	(3) Turkish teachers (n=10) (Mean, S.D.)	(4) British teachers (n=10) (Mean, S.D.)	(5) Canadian teachers (n=10) (Mean, S.D.)	F (ANOVA)	P
1	3.87 (1.68)	2.60 (1.68)	3.00 (1.56)	3.20 (1.55)	3.90 (1.37)	1.649	.175
2	3.40 (1.80)	3.20 (1.78)	3.90 (1.37)	2.80 (1.55)	3.60 (1.43)	.658	.624
3	5.00 (.000)	4.40 (1.24)	4.60 (.966)	4.90 (.316)	5.00 (.000)	1.706	.162
4	1.80 (1.69)	1.00 (.00)	1.26 (1.03)	1.80 (1.69)	1.00 (.000)	1.497	.267
5	2.33 (1.11)	3.00 (1.46)	3.00 (1.33)	3.00 (1.56)	2.20 (1.03)	1.110	.361
6	2.27 (1.33)	1.93 (.961)	2.00 (1.15)	2.90 (1.20)	2.60 (1.51)	1.229	.309
7	2.73 (1.71)	2.20 (1.66)	2.10 (1.59)	2.20 (1.55)	2.50 (1.96)	.313	.868
8	4.20 (1.08)	3.53 (1.36)	4.00 (.943)	4.20 (.632)	4.20 (.789)	1.081	.375
9	3.27 (1.71)	1.73 (1.03)	2.00 (1.15)	2.30 (.949)	2.80 (1.32)	3.178	.020
10	2.80 (1.37)	1.80 (.422)	2.40 (1.17)	3.60 (1.43)	2.53 (1.36)	2.830	.033
11	1.33 (.816)	1.00 (.000)	1.40 (.516)	1.00 (.000)	1.00 (.000)	2.250	.076
12	4.80 (.414)	4.93 (.258)	4.80 (.422)	4.70 (.949)	5.00 (.000)	.651	.629
13	2.47 (1.77)	2.07 (1.83)	2.70 (2.00)	1.50 (1.27)	1.40 (1.26)	1.243	.304
14	1.00 (.00)	1.27 (1.03)	1.80 (1.69)	1.80 (1.69)	1.00 (.000)	1.497	.216
15	3.87 (1.55)	3.52 (1.77)	2.80 (1.93)	3.80 (1.75)	4.70 (.949)	1.777	.147
16	4.80 (.775)	4.13 (1.51)	4.00 (1.63)	4.50 (.972)	4.90 (.316)	1.384	.252
17	4.07 (1.16)	3.47 (1.30)	4.00 (1.15)	4.10 (.316)	4.00 (1.15)	.780	.543

Empirical evidence and research perspectives on the use of didactic video: with a focus on the health professions

Giovanni Ganino^{a,1}

^a*University of Ferrara, Humanities department – Ferrara (Italy)*

(submitted: 18/9/2021; accepted: 31/12/2021; published: 31/12/2021)

Abstract

The article presents a brief overview and a critical analysis of the emerging evidence in international literature regarding the use of audiovisual texts, with a focus on the didactic video to support professional medical education. The study of cognitive artifacts used in the representation of knowledge is not a new phenomenon, but with the Covid-19 emergency there has been renewed interest in this area of research. Evidence highlights how audiovisual texts can perform very diversified, rich and stimulating functions from a pedagogical point of view. In particular, a new direction of research on the significant role of the camera point of view (first person or subjective) in learning complex manual procedures is of great interest in the health professions. A number of critical issues are also clear.

KEYWORDS: Instructional Video, Audiovisual Texts, Procedural Knowledge, Video and Medicine, Subjective Shot.

DOI

<https://doi.org/10.20368/1971-8829/1135561>

CITE AS

Ganino, G. (2021). Empirical evidence and research perspectives on the use of didactic video: with a focus on the health professions. *Journal of e-Learning and Knowledge Society*, 17(2), 97-107.
<https://doi.org/10.20368/1971-8829/1135561>

1. Introduction

The reference area of the didactic video is video-based learning, a research sector that deals with theoretical and methodological aspects on the principles of knowledge construction through cognitive artefacts based on visual/audiovisual/sound/multimedia languages and network technologies. This broad definition includes both television texts (now a minority, hence negligible) and videos, categorized according to procedures and terminologies not yet standardized at international level. However, each of these is functional to the construction of different types of knowledge, factual, conceptual, procedural, metacognitive: video lessons recorded ad hoc, video

lessons that capture the classroom lesson, multimedia presentations (such as PowerPoint) with voiceover, screencasts (with voiceover), live lessons in web conference, educational videos, educational television programs, knowledge clips. The list does not include all the existing forms, and contamination between the cited texts appears to be common (Ganino, 2018).

In recent years, the spread of new teaching methods such as, flipped, blended and MOOCs, alongside different uses of e-Learning, has led to new interest in educational research on audiovisual technology the different textual forms of which seem central to all educational processes supported by the use of telematics. Not to mention the Covid-19 health emergency which resulted in the transfer of all teaching to digital environments within which audiovisual texts were used as the main teaching medium.

Numerous studies carried out over the last 20 years show how videos can be highly effective in training processes if the rules of Instructional design are respected: correct management of the cognitive load; enhancement of cognitive theories of multimedia learning; promoting student engagement; enhancement of active learning. These are all points, especially the first two, which have been widely discussed, but which

¹ corresponding author - email: giovanni.ganino@unife.it

have not yet been actively applied in teaching practices (Sweller et al., 2019).

2. Materials and Methods

2.1 The Method

The analysis of international literature relating to the use of educational videos in vocational health education, proposed in this study, is an in-depth analysis of a wider contemporary review on the use of all audiovisual texts in teaching and learning processes in the university environment. This review, partially reported below (par. 3.1 and 3.2), was carried out according to an adaptation of the six-phase process in accordance with the theory developed by Machi and McEvoy (2016) and integrated, for point 3, with a protocol relating to the Prisma guidelines (Liberati et al., 2015). The study that examined the period 2010-2019 identified 95 articles, analyzed and organized into different themes: video and involvement, video and motivation, video and laboratory teaching, taxonomies and forms, design (duration, segmentation, camera point of view, instructor role in video, the forms of human representation). The evidence obtained is useful understanding more about the communicative and psychological mechanisms whose application can be functional to the improvement of learning processes that make use of educational audiovisual texts. This applies to all areas of knowledge, therefore also professional health education. For this reason, as mentioned, a summary is provided. From the same analysis it appears that one of the texts analyzed, the educational video, is of great interest for learning complex manual procedures in the health professions. We explored this use in this second review on the educational video in the field of health professions referring to the year 2020 performed with the same method as the previous one (Machi & McEvoy, 2016; Liberati et al., 2015).

2.2 Identification of the topic and definition of the problem to be investigated (Steps 1 and 2)

Starting from the research objective – to verify the use of the didactic video in learning procedural skills in the health professions – the following questions were asked:

Q1. *Is there any scientific evidence relating to the didactic functionality of the video in terms of procedural knowledge learning?*

Q2. *Are there any guidelines that could help with the correct design of educational videos in the medical / health field to facilitate the learning of procedural knowledge?*

2.3 Data collection and organization (Step 3)

For the identification and selection of scientific literature, primary and secondary studies on the subject, the databases were queried through the Library System of the University of Ferrara (cerc@unife, EBSCO Discovery Service):

1. the research and related analysis were carried out in December 2020 and the first half of January 2021;
2. the research was limited to articles published in 2020;
3. Elsevier Science Direct, ISI Web of Science, JSTOR, Open Dissertations, Scopus, SpringerLink, Wiley Online Library, Rivisteweb-II Mulino / Carocci databases were consulted.

A series of peer reviewed academic publications with links to the full text were selected, through the following search keywords and related Boolean operators: instructional video OR educational videos AND healthcare AND professional. 1544 studies were identified. 24 reviews and research reports have been deleted from these. The research was refined through the selection of contributions aggregated according to the following categories: education (59), learning (13), training (22), flipped classrooms (44), e-Learning (23), online learning (16), meta-analysis (22), medical education (20), teaching methods (19), online education (17), active learning (16), mobile apps (15), instructional film (45), educational technology (22), higher education (12), online education (20), educational films (16), distance education (14), blended learning (12). This trial identified 427 items. The relevance to the goal of our analysis was more precisely identified by reading the abstracts. 44 articles were selected from this process. Finally, through full text reading, seven articles remained. All the studies that did not deal with specific topics with respect to the research questions were eliminated (Figure 1).

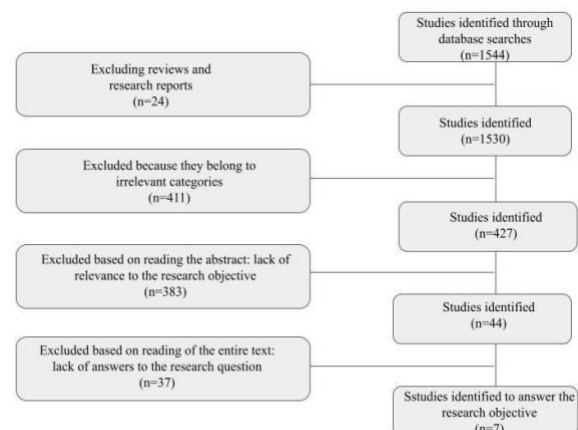


Figure 1 - Flow chart of the studies included in the review.

2.4 Identification and organization of data (Step 4)

Table 1 shows the identification of the data on the basis of which the critical analysis was carried out with respect to the research question.

3. Results

Data analysis and review processing (Steps 5 and 6). As mentioned, before reporting the results of the review on the didactic video used in the health professions (paragraph 3.3) it seems appropriate, for the sake of completeness of the topic, to report evidence on audiovisual texts in general. As these data are not yet published, we prefer to report them in this part of the article rather than in the "Introduction" paragraph. They may be considered complementary to the review on the didactic video in the field of health professions and very useful to researchers, teachers, instructional designers interested in the topic. For the same reason, the analysis of an article on the camera point of view (Boucheix et al., 2018) was included in paragraph 3.3.2 Healthcare perception and learning: use of the dual camera point of view.

The evidence shows how educational audiovisual texts can have a significant impact on learning as long as they are made on the basis of specific theoretical paradigms that constrain their use. Particularly interesting are the studies on the significant role of the integrated camera point of view, objective and subjective, in the context of learning complex manual procedures; on the modalities of representation of the teacher and on his/her communicative attitude; on the increasingly close relationship between educational sciences and neuroscience.

3.1 Taxonomy of educational audiovisual texts

In the face of many studies that show how the use of multimedia documents in certain conditions improves

learning, there is still little evidence on the effectiveness of the different teaching formats. Although these formats are normally used in teaching practices, the reference literature appears insufficient. Evaluating how different formats can influence attention, engagement, emotions, cognitive load and learning performance would significantly contribute to the growth of this research area. For this reason, the data reported in this paragraph must be integrated with those on the design of the didactic audiovisual text (next paragraph).

Our analysis highlights the lack of a shared classification of audiovisual texts at international level and this does not facilitate analysis and comparison between studies. The categories (C) identified are listed below. Chen and Wu (2015) report 3 different types of video lessons in their experimental study.

1. *Lecture capture* (C1). Full recording of the conventional lesson, very long for asynchronous use but characterized by the ability to preserve the view of the teacher-student relationship that takes place in the classroom.
2. *Voice over* (C2). Audiovisual text composed of a multi-window template containing the multimedia presentation, the image of the teacher and the index of contents. In this format in which the learning context is lacking, speech takes on utmost importance.
3. *Picture in picture* (C3). Format widely adopted in MOOCs, it shows the teacher according to an integrated solution rather than a separate one, as in the voice over model, within the multimedia presentation.

Other studies report the following formats.

4. *Formats determined by the MOOC platform* (C4). Hansch et al. (2015) identified up to 16 types of video lesson presentation formats within the various MOOC platforms; Thompson the Khan Academy style focused on creating an intimate and close

	Authors and year	Focus of interest	Content	Research's methodology
1	Lim & Hu (2020)	Video-modelling	Autism spectrum disorder	Experimental with blinded evaluation
2	Eimer et al. (2020)	Video and peer education	Abdominal ultrasound, transthoracic ultrasound	Experimental single-blind prospective study
3	Yeap et al. (2020)	Video and procedural skills	Thoracic epidural anesthesia	Prospective randomized study
4	Bajaj et al. (2020)	Open educational resources	Glasgow Coma Scale	Prospective study
5	Tewfik et al. (2020)	YouTube and scientific quality	Regional nerve block	Retrospective observational study
6	Ulmer et al. (2020)	Video and procedural skills	Emergency tracheostomy	Experimental
7	Schmidt et al. (2020)	Role of the camera point of view	Laparoscopic suture	Experimental with blinded evaluation

Table 1 - Summary of the extrapolated data from the identified studies.

relationship between the teacher and the individual student (2011, in Chorianopoulos, 2018); Guo et al. (2014) identified six presentation styles within the edX platform: Classroom, recording of the live lesson with an instructor on the blackboard; Office desk, the teacher's talking head behind his desk; Khan Style, use of digital whiteboard for writing and drawing; Slides, illustration of slides with voiceover; Study, recording the lesson in a television studio in the absence of students; Cood, screencast / computer coding session.

5. *Formats determined by the disciplines (C5)*. Santos-Espino et al. (2016) divided the audiovisual texts into two main categories, speaker-centric and board-centric, and identified a preference for use according to the disciplines involved.

These formats provide a general idea of the different possibilities without, however, going into the specifics of their use depending, for example, on the type of knowledge to be activated. It seems useful to report our classification based on structural characteristics (Ganino, 2018) based on the intersection of some categories - modes of use, synchronous or asynchronous; duration, short or long; methods of presentation of the contents, closed and uniconceptual or open and argumentative; paradigm employed, transmissive, interactive, mixed; social presence, of teacher or lecturer and students; type of teaching, conceptual or experiential - and macro categories, video lessons, web conference lessons, didactic videos.

6. *Video lesson (C6)*. The video lesson macro-category, regardless of its form, is an audiovisual text with a high semantic density which can be used in asynchronous mode. It brings together a sense of social presence and authoritativeness of the contents, through the presentation of the teacher and visual exemplification of the concepts covered, through the correct use of multimedia design principles. In practice, it is a transmissive text based on a behavioral logic: interaction is not normally envisaged during use and declarative knowledge is acquired by the student through self-learning. This didactic resource must be supported by the clarification of a precise didactic objective, a short duration and a uniconceptual structure. In practice it is a rigid cognitive artifact, but which can build the basic factual and conceptual pre-knowledge/knowledge of a discipline, fundamental to the activation of learning through integration with other cognitive artifacts, such as lessons in web conferences and e-tivities, or with face-to-face lessons (as in the flipped and blended models).
7. *Web conference lesson (C7)*. The web conference lesson macro-category is a synchronous audiovisual text characterized by an interactive paradigm and a strong social indicator component (teacher and students): this determines effective teaching processes thanks to the possibility of reducing the

risks of misunderstandings present in asynchronous communication. The web conference lesson can promote teaching dominated by the concept of openness, which can go beyond rigid definitions or superficial knowledge, based on conceptual reflections, argumentation and the game of mental associations as happens in classroom lessons held by an experienced teacher.

8. *Didactic video (C8)*. The didactic video macro-category refers to an audiovisual text which, like the video lesson, is characterized by a didactic objective which is as precise as possible, a single-concept structure and short duration, a transmission model, intended for experiential teaching, which is less conceptual and theoretical and more workshop-based (procedural knowledge). It is an educational resource used to explore information that does not lend itself to being transmitted through spoken or written language: mechanical processes, manual and clinical skills, procedures that take place in inaccessible laboratories, but also images to stimulate emotions and feed imagination and creative thinking. In practice, the result of the viewing must have a significant impact on the student's ability to solve problems or carry out processes and procedures.

3.2 Didactic audiovisual text design

Scientific evidence shows how the audiovisual texts referred to in the previous paragraph can have a significant impact on learning if they are built on the basis of precise theoretical paradigms. Here we report those that seem most significant for the advancement of pedagogical research and useful for identifying new guidelines in the field of educational multimedia production.

Cognitive load and multimedia learning. The design of these texts is based on a series of now classic studies on the theories of cognitive load and multimedia learning (Sweller, van Merriënboer, & Paas, 1998; 2019; Clark & Lyons, 2010; Mayer, 2009) whose application tends to enhance the teaching and learning process through the reduction of the extraneous cognitive load, the improvement of the pertinent one, and the management of the intrinsic one. A series of recent studies in the field of cognitive neuroscience appears to be interesting: some on the techniques for measuring cognitive load and a more general study on the progress of the discipline. Recent research related to classical subjective cognitive load measurement techniques with the use of 9-level Likert scales (Anmarkrud et al., 2019) concerns new physiological assessments (by electroencephalography) of the electrical oscillation activities of the brain during active information processing: in the presence of a greater cognitive demand, the power of the theta band increases and that of the alpha band decreases (Kumar & Kumar, 2016; Soltanlou et al., 2017). The progress of cognitive load

studies and related applications in instructional design, indicated below, are described in a recent publication by Sweller and colleagues (Sweller et al., 2019): variability of the amount of information processed and stored in working memory (Chen et al., 2018, in Sweller et al., 2019) and overcoming the idea according to which this quantity of information would be fixed (this is considered the “bottleneck” of learning); self-regulation by the student of their own learning resources; the influence on the cognitive load of environmental factors such as stress, emotions and cognitive insecurity (Choi et al., 2014, in Sweller et al., 2019).

Video representation of the instructor. A second area of advancement of the research concerns the representation of the instructor in videos according to design principles based on the function of complementarity between the talking head and the visual message: specifically, the significant enhancement of the teacher’s image in terms of the functional use of gestures, looks and mode of representation. Naturally, the first aspect to consider concerns the presence or absence of the so-called “talking head” in relation to two reference theories, social presence and cognitive load. The evidence related to the paradigm of social presence refers to greater involvement that determines the student’s motivation, interest and willingness to cooperate. This results in greater student satisfaction and the student’s perception of having learned more (Kizilcec et al., 2015; Lyons et al., 2012; Wilson et al., 2018, Guo et al., 2014) hence classifying the audiovisual texts in which their professors are present as more effective than those of other suppliers (even in the case of comparable content in quality). However, this is not always the case; other experiments have not found any obvious advantage due to the presence of the instructor (Kizilcec et al., 2014) and highlighted obstacles to learning (Wilson et al., 2018). For example, many studies based on eye tracking and linked to cognitive load theory see the image of the instructor as a cause of divided attention (Kizilcec et al., 2014; Wang & Antonenko, 2017). For these reasons, as mentioned, it is very important for the design principles to attribute a complementary function to the communicative and significant processes resulting from the actions of the talking head (principle of gestures, gaze, dynamic design) and the overall visual message. Gestures can play a significant role but only when they have a clarification and extension function, highlighting of the content with the aim of positively influencing conversational exchange and the multimedia didactic message (Fattorini & Paoletti, 2017; Poggi & Caldognetto, 1997). In this sense, illustrative and significant gestures promote both the learning process, in terms of greater propensity to remember (Feyereisen, 2006 in Fattorini & Paoletti, 2017), and the teaching process, in terms of better expressive ability and reduction of pauses associated with lexical retrieval

difficulties (Cook et al., 2012 in Fattorini & Paoletti, 2017). Research also indicates that the gaze can play a role in multimedia learning where it operates as a visual guide to the student’s attention, thus preventing divided attention phenomena. A very useful tool for putting into practice this mechanism capable of enhancing the paradigms of social agency and the reporting principle seems to be the transparent board (Mayer, 2014). Hand movement (Fiorella & Mayer, 2016) and the connected principle of dynamic drawing (Mayer et al., 2020) are to be understood in the same direction. The former can reduce extraneous cognitive load by directing attention towards relevant information, continuously and at the right time (as in the signaling principle). The latter, that is the composition of the didactic message through the technique of dynamic drawing, promotes a greater spirit of cooperation as indicated by the social agency theory (Mayer, 2014) and a greater sense of self-referentiality in the perspective of the theory of incarnation (Robbins & Aydele, 2009).

The camera point of view. A new research topic in the field of educational video design concerns the complementary use of the double camera point of view, objective or in the third person, subjective or in the first person. This use would lead to an increase in the activation of the neuron system (Theory of mirror neurons) and positive phenomena on learning processes. This implies greater involvement and an improvement in the processes of memorization and subsequent recall of information (Garland & Sanchez, 2013; Jannin et al., 2017), greater effectiveness in remembering and putting into practice subjective processes thanks to psychological self-reference factors (Bugajska et al., 2015) and incarnation/personification (embodiment theory) according to which people learn with the body beyond the mind (Robbins & Aydele, 2009). The subjective point of view creates a state of self-reference (what the student sees refers to himself) and identification with what is being observed and therefore a greater propensity for deep learning. This likely simulation of the media-based learning experience makes it easier to put the observed procedure into practice (transfer).

3.3 Procedural didactic video and health professions

In the review of the literature referring to the year 2020 we identified seven articles with clear reference to the use of the educational video to support the health professions. Six of these made general reference to the category and were then categorized according to their potential in the health sector. One, on the other hand, dealt with a subject of extreme novelty and certain interest for the health profession sector, namely the combined use of the dual point of view of the camera, the subjective or first-person point of view and the objective or third person point of view. This data confirms what appeared in the 2010-2019 review. In this paragraph, in the part focusing on the double point

of view of the camera, we propose the analysis of the two studies: that of Boucheix et al. (2018) identified in the more general review and that of Schmidt et al. (2020) identified in this review more specific to the health sector.

3.3.1 Potential of the didactic video in the health sector

Lim and Hu (2020) evaluated the effectiveness of a video-modeling procedure (behavior is represented through a role-playing game or in a real-life scenario), including voiceover and lettering, aimed at Chinese operators who work with children with autism spectrum disorder. After participating in four 10-minute video intervention sessions, all the participants reached the criterion of mastery and generalization of the teaching skills learned, also maintained afterwards as demonstrated by the follow-up phase. The effectiveness of the intervention is also certified by the inclusion in the study of five experienced behavior observers.

Eimer et al. (2020) verified the didactic functionality of two videos, on ultrasounds for basic and advanced abdominal ultrasound and transthoracic echocardiography, whose vision was supported by the support of a specially trained student-tutor. The experiment showed that the learning outcomes did not differ from those of students trained in a conventional way, by the teacher without the support of the didactic video. The study highlights an interesting educational scenario, especially in degree courses with a large number of students, within which self-learning with the aid of a multimedia educational resource can be supported by a peer-education model.

Yeap et al. (2020) evaluated the effectiveness of an educational video on the placement of the catheter for thoracic epidural anesthesia by anesthesia specialists. In the research procedure, the control group was subjected to the conventional training method (education in the ward, individual study through resources such as textbooks and online content). Before performing the epidural anesthesia, the experimental group was also invited to watch the video. Contrary to the hypothesis, the use of video did not improve the performance of the trainees (time required to complete the procedure and evaluation of the correct insertion of the needle) compared to those of their colleagues. This in the researchers' indications could be due to the quality of external training resources (perhaps even videos equivalent to that used by the experimental group) used by the control group trainees and not taken into account in the experimental activity. Therefore, further and more in-depth research activities are recommended in this context.

A particularly interesting topic now appears to be the use of open educational resources. Bajaj et al. (2020) verified the didactic effectiveness of a video on the objective evaluation of the Glasgow Coma Scale

(SCG), available in open mode online, on the glasgowcomascale.org website. Watching the video resulted in a significant improvement in the SCG score by general surgery residents, assessed through responses given in a series of specific tests within a prospective study and a blinded control by an experienced neurosurgeon.

Tewfik et al. (2020) worked on the correct use of open educational resources. Specifically, the authors indicate a functional methodology for the attribution of scientific validity and educational quality of the videos on YouTube that deal with the topic of education of the regional nerve block, through a comparison with educational sources of recognized scientific quality on the same topic. In these sources, the educational characteristics relating to the seven nerve blocks (indications, volume, anatomy, etc.) have been classified. The presence of these elements was subsequently verified in the five most popular videos on YouTube for each nerve block. The results showed that YouTube videos do not contain an appreciable percentage of the educational features needed in this area. Therefore, it is not recommended to use them as part of the education of the nerve blocks of regional anesthesia.

In a research paper by Ulmer et al. (2020) the learning curve relating to the simulated execution of an emergency tracheotomy (eFONA) in the pediatric setting in a didactic video situation was studied. After watching the video, 50 doctors from five different specialisms performed 10 emergency tracheotomies on rabbit corpses. The analysis of their learning curves showed an overall success rate of 94%, with a decrease in execution time from 107 to 55 seconds in 10 attempts. The video instructions allowed rapid acquisition of the skills of this invasive technique. However, it should be emphasized that in the authors' indications, the study does not intend to encourage the practice of emergency tracheotomy in the clinical setting. This is one of the most terrifying situations that a doctor can experience, so it is advisable to cross future research on the use of video texts in this area with the corresponding research concerning the correct management of the intrinsic cognitive load in the presence of environmental factors related to the task, such as stress, emotions and insecurity.

3.3.2 Healthcare perception and learning: use of the dual camera point of view.

The complementary use of the dual audiovisual gaze, objective and subjective, seems to be very useful in the context of procedural learning. The reference scientific theories have already been mentioned. We add how the ability to learn procedures from observation is attributable to the effectiveness of our mirror neuron system and a related neurophysiological circuit that is activated when someone is observed in the act of carrying out an action (Rizzolatti & Craighero, 2004).

This is even more effective when at certain times during the process two different points of view alternate, objective or external (otherwise known as third person), subjective or internal (first person). This functional learning mechanism not only in imitation from observation but also in memory, understanding and transfer, points towards the use of video, structured according to this communication mode, in high-risk professional training, such as in the medical field.

This communication modality was tested by Boucheix et al. (2018) for learning a process related to the insertion of a urinary catheter into the human body simulated by a manikin, aimed at 43 French students divided into 3 experimental groups. The researchers made 3 different videos of the same duration but from different perspectives, frontal, subjective, mixed (the video made according to this procedure involved the performance of some steps according to a mixed mode and others according to first- or third-person mode), to verify the effectiveness of the different points of view. The overall procedure was broken down into 25 steps divided into 5 modules in order to analyze the functionality of the different points of view based on the specificity of the various manual operations. The effectiveness in terms of overall highest scores in the verification tests was found to be the video made from the dual point of view. The use of the single, frontal and subjective perspective used in the other videos did not show significantly different scores.

The in-depth analysis (comparison between the individual steps into which the video was broken down) of the results of the use of the video made primarily according to the double point of view (some steps were carried out exclusively in the first or third person, others according to the integration of the double point of view) has also shown how some processes require a representation based on several points of view, others on a single point of view, sometimes in the first person, others in the third: in practice it is suggested how the staging of the didactic video, in terms of analytical breakdown and points of view adopted (mixed, first or third person), depends on the type of task/procedure to be learned. The results of the three experimental groups were finally compared with those of a fourth, control group, not subjected to video viewing. This comparison showed better results for the 3 experimental groups (subjected to video with mixed or single perspective) compared to the control group, confirming the effectiveness of the video in procedural learning (Ganier & de Vries, 2016).

The method of construction of the didactic video according to the double point of view procedure was also applied in a paper by Schmidt et al., (2020) related to a self-training didactic activity on laparoscopic suture and knot tying. The experimental project with the presence of blinded evaluators aimed at medical students and carried out at the University of Heidelberg, in Germany, investigated, on the one hand, the

influence on learning curves related to the acquisition of procedural skills (the laparoscopic suture and ligation of the knot according to the C-loop technique) through the use of a didactic video made according to a mixed perspective, in first and third person. On the other hand it investigated the feasibility of a self-training didactic curriculum (or mixed training) through the use of e-Learning methodologies, still in the same context (aspect not investigated in our analysis). Two groups of students watched the instructional video on laparoscopic suturing and knot tying three times before each training session. The first group was subjected to viewing a video made from the mixed perspective, consisting of first person images (view of the hands, instruments and forearm movement) and in the third person (the endoscopic image); the second group was subjected to the viewing of a video composed exclusively of an endoscopic view. Written or oral instructions on how to perform the C-loop technique were not provided in the videos or in person. The results highlighted a positive perception on the use of the first-person perspective by the participants of both groups (after the study all the participants watched the video of the opposite group before giving their subjective opinion). However, the correlation between positive subjective perception and learning outcomes showed no significant differences between the two groups: the average training time to reach the competency required by the protocol was similar.

This partly confirms what has already been identified regarding the work of Boucheix et al. (2018) in terms of appropriateness of the type of manual procedure to be learned and the points of view adopted (mixed, first or third person). Not surprisingly, in the authors' indications, research on this topic recommends the use of third-person images for learning basic laparoscopic skills, and first-person images for learning more complex skills (whose learning would be favored by the possession of good psychomotor skills). This means that laparoscopic suturing and knot tying as an advanced task poses high psychomotor challenges to inexperienced subjects. The contradiction between subjective perception and objective performance by the participants in this study could therefore have been influenced by various factors, aesthetic-communicative, didactic content and pre-knowledge requirements.

4. Discussion

The evidence identified in the two reviews highlighted how audiovisual texts, if created and used on the basis of specific communicative-didactic paradigms, can perform rich and stimulating functions from a pedagogical point of view. Research is investigating the role of different formats on attention, involvement,

emotions, cognitive load and learning performance, new principles in the field of cognitive load theory and related measurement techniques. Many studies investigate innovative design principles in terms of representation of the instructor on video. In particular, it was seen as a new direction of research on the significant role of the camera point of view (first person or subjective) in learning complex manual procedures of great interest to the health professions. There are also a number of critical issues relating to the discrepancy of the results. For this reason, it is important to

underline that, in order to obtain scientific evidence far from positivist attitudes in this area, there is still a need for controlled interventions, in a laboratory situation, and for a greater number of studies, with greater participation of the subjects involved.

Finally, Table 2 summarizes a series of standard indications useful for the creation of educational videos for training or research purposes integrated by the new principles, highlighted in italics, identified in this work, recalling the need for teamwork, given the complexity of the process, which involves, in addition to the

<i>Narrative structure</i>	Introduction: specify the theme and the goals.
	Structure: as unique as possible conceptual and thematic.
	Talk about procedural knowledge aimed at solving problems.
	Stimulate active participation and encourage processes of critical reflection and theoretical elaboration.
	Conclusions: summarize the operations / procedures / skills that must be put into practice (transfer).
<i>Duration</i>	Short. If long, use the principles of segmentation and modularity.
<i>Access modality</i>	Asynchronous / Synchronous
<i>Contents exposure mode</i>	Closed and declarative, functional to a transmission paradigm.
	Lexical and syntax adaptation (short periods, no subordinates, few relative ones, use of active form), syntactic criteria of coordination (parataxis) rather than subordination (hypotactic).
<i>Content adaptation</i>	Consider the optimal density of content, simplification without conceptual reduction, linear exposure without digressions, "stimulation" capable of creating attention and participation.
<i>Design principles</i>	Teacher in video, to foster a sense of social presence and authoritativeness of the content (in front of the real blackboard, behind the transparent blackboard, behind the desk, in a TV studio, in a research laboratory).
	Provide alternation between the presence and absence of the teacher on video.
	Visual and sound message relationship according to a complementary and non-redundant logic.
	Pay attention to the management of the correct cognitive load and active information processing.
	Pay attention to the principles of multimedia learning
	Consider the pace of presentation of contents based on their reading complexity and the characteristics of the users.
	<i>Consider the teacher's communicative attitude: principles of gestures, gaze, dynamic drawing.</i>
	<i>Consider the camera point of view (subjective, third person, mixed) based on the type of task / procedure to be learned.</i>
<i>Technical principles</i>	Importance of voice over recording and live audio without annoying noises.
	Importance of editing operations (possible soundtrack, insertion, slow motion effects, repetition procedures, time lapse, enlargements, etc.).

Table 2 - Summary framework and guidelines of the didactic video useful for researchers, teachers, instructional designers.

teacher, experts in instructional design and multimedia technologies if sustainable projects from an educational point of view are the intended direction.

6. Conclusion

The analysis carried out shows that we no longer need to ask ourselves whether video technologies improve learning, rather, under which conditions this takes place.

Faced with the forced normalization process of these technologies, in the era of the health emergency, it is necessary to think about an educational model and the corresponding design capable of optimizing the learning potential and minimizing critical elements. We have seen how audiovisual texts, in their versatility, can perform very diversified, rich and stimulating functions from a pedagogical point of view. In particular, the use of the first-person perspective in educational videos functional to learning procedural skills and knowledge has become of great interest in the healthcare professions (Thomson et al., 2017; Fukuta & Morgan, 2018). The improvement and application of this methodology within the laboratory-based teaching of medical degree courses and health professions can respond to needs of a qualitative nature (improving the learning processes of complex manual procedures) and logistics (the number of students in the medical/health area has significantly increased in many Italian universities, making it difficult to attend practical and laboratory activities). But this is also applicable to all post-pandemic teaching: scientifically validated digital educational resources can make an important contribution to the challenges that university education will necessarily have to face in the coming years.

References

- Anmarkrud, O., Andresen, A., & Bråten, I. (2019). Cognitive Load and Working Memory in Multimedia Learning: Conceptual and Measurement Issues. *Educational Psychologist*, 54 (2), 61-83. doi:10.1080/00461520.2018.1554484
- Bajaj, J., Rathore, S., Parihar, V., Agarwal, P., Ram Yadav, Y., Sharma, D. (2020). Teaching Glasgow Coma Scale Assessment by Videos: A Prospective Interventional Study among Surgical Residents. *Journal of Neurosciences in Rural Practice*, 11(03), 381-384. doi:10.1055/s-0040-1709263
- Boucheix, J.M., Gauthier, P., Fontaine, J., & Jaffeux, S. (2018). Mixed camera viewpoints improve learning medical hand procedure from video in nurse training? *Computers in Human Behavior*, 89, 418-429. doi: 10.1016/j.chb.2018.01.017
- Bugaiska, A., Ferreri, L., Bouquet, C.A., Kalenzaga, S., & Clarys, D. (2015). Self as a moderator of age-related deficit on Recollection. *Topics in Cognitive Psychology*, 115, 77-88. doi:10.4074/S0003503314000013
- Chen, C.M., & Wu, C.H. (2015). Effects of different video lecture types on sustained attention, emotion, cognitive load, and learning performance. *Computer & Education*, 80, 108-121. doi: 10.1016/j.compedu.2014.08.015
- Chorianopoulos, K. (2018). A Taxonomy of Asynchronous Instructional Video Styles. *International Review of Research in Open and Distributed Learning*, 19(1). doi:10.19173/irrodl.v19i1.2920
- Clark, R., & Lyons, C. (2010). *Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials*. San Francisco: Pfeiffer.
- Eimer, C., Duschek, M., Jung, A.E. Emanuel, A., Günther, Z., Amke, C., Matthias, L., Norbert, W., Gunnar, E. (2020). Video-based, student tutor-versus faculty staff-led ultrasound course for medical students – a prospective randomized study. *BMC Med Educ* 20 (1). doi:10.1186/s12909-020-02431-8
- Fattorini, R., & Paoletti, G. (2017). Mettiamoci la faccia. L'uso dei Talking Head nelle lezioni online. *Form@re. Open Journal per la formazione in rete*, 17(1), 217-227. doi:10.13128/formare-20163
- Fiorella, L., & Mayer, R.E. (2016). Effects of observing the instructor draw diagrams on learning from multimedia messages. *Journal of Educational Psychology*, 108(4), 528-546. doi:10.1037/edu0000065
- Fukuta, J., Morgan, J. (2018). First-person perspective video to enhance simulation. *Clin Teach*, 15, 231–235. doi:10.1111/tct.12659
- Ganier, F., & de Vries, P. (2016). Are instructions in video format always better than photographs when learning manual techniques? The case of learning how to do sutures. *Learning and Instruction*, 44, 87-96. doi: 10.1016/j.learninstruc.2016.03.004
- Ganino, G. (2018). *Video didattica. Comunicazione visiva, apprendimenti multimediali e processi cognitivi*. Lecce-Brescia: PensaMultiMedia.
- Garland, T.B., & Sanchez, C.A. (2013). Rotational perspective and learning procedural tasks from dynamic media. *Computers and Education*, 69, 31-37. doi: 10.1016/j.compedu.2013.06.014
- Guo, P. J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: An

- empirical study of mooc videos. In *Proceedings of the First ACM Conference on Learning@ Scale Conference*, 41-50. doi:10.1145/2556325.2566239
- Hansch, A., Hillers, L., McConachie, K., Newman, C., Schildhauer, T., & Schmidt, P. (2015). Video and online learning: Critical reflections and findings from the field. *HIIG Discussion Paper Series N. 2015-02*. doi:10.2139/ssrn.2577882
- Jannin, L., Ganier, F., & deVries, P. (2017). Effet du point de vue de présentation des instructions et de l'aptitude à la rotation mentale sur l'apprentissage d'un geste technique. *Conférence EPIQUE, Dijon, France*.
- Lyons, A., Reysen, S., & Pierce, L. (2012). Video lecture format, student technological efficacy, and social presence in online courses. *Computers in Human Behavior*, 28(1), 181–186. doi:10.1016/j.chb.2011.08.025
- Kizilcec, R.F., Bailenson, J.N., & Gomez, C.J. (2015). The instructor's face in video instruction: evidence from two large-scale field studies. *Journal of Educational Psychology*, 107(3). doi:10.1037/edu0000013
- Kizilcec, R.F., Papadopoulou, K., & Sritanyaratana, L. (2014). Showing face in video instruction: effects on information retention, visual attention, and affect. *Proceedings of the 32nd annual ACM conference on Human factors in computing system*, 2095-2102. doi:10.1145/2556288.2557207
- Kumar, N., & Kumar, J. (2016). Measurement of cognitive load in HCI systems using EEG power spectrum: An experimental study. *Procedia Computer Science*, 84, 70–78. doi:10.1016/j.procs.2016.04.068
- Liberati, A., Altman, D. G., & Tetzlaff, J. (2015). PRISMA Statement per il reporting di revisioni sistemiche e meta-analisi degli studi che valutano gli interventi sanitari: spiegazione ed elaborazione. *Evidence*, 7(6), 1–36.
- Lim, N., Hu, X. (2020). The effects of video modeling on staff implementation of behavioral procedures in China. *Behavioral Interventions*, Wiley, 35(4), 704-716. doi:10.1002/bin.1735
- Machi, L.A., & McEvoy, B.T. (2016). *The literature review: Six steps to success*. Thousand Oaks, CA: Corvin Press.
- Mayer, R.E. (2009). *Multimedia learning*. New York: Cambridge University Press.
- Mayer, R.E. (2014). Multimedia instruction. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.). *Handbook of Research on Educational Communications and Technology*, 385-399. New York: Springer.
- Mayer, R.E., Fiorella, L., & Stull, A. (2020). Five ways to increase the effectiveness of instructional video. *Education Tech Research Dev*, 68(3), 837–852. doi:10.1007/s11423-020-09749-6
- Poggi, I., & Caldognetto, E.M. (1997). *Mani che parlano. Gesti e psicologia della comunicazione*. Padova: Unipress.
- Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience*, 27, 169-192. doi:10.1146/annurev.neuro.27.070203.144230
- Robbins, P., & Aydele, M. (2009). A short primer on situated cognition. In P. Robbins & M. Aydede (Eds.), *The Cambridge handbook of situated cognition*. New York: Cambridge University Press.
- Santos-Espino, J.M., Afonso-Suàrez, M.D., & Guerra-Artal, C. (2016). Speakers and boards: A survey of instructional video styles in MOOCs. *Technical Communication*, 63(2), 101-115.
- Schmidt Mona, W., Kowalewski, K.F., Trent, S.M., Benner, L., Müller-Stich, B. P., & Nickel, F. (2020). Self-directed training with e-learning using the first-person perspective for laparoscopic suturing and knot tying: a randomised controlled trial. *Surgical Endoscopy*, 34(2), 869–879. doi:10.1007/s00464-019-06842-7
- Soltanlou, M., Artemenko, C., Dresler, T., Haeussinger, F. B., Fallgatter, A. J., Ehlis, A. C., & Nuerk, H. C. (2017). Increased arithmetic complexity is associated with domain-general but not domain-specific magnitude processing in children: A simultaneous fNIRS-EEG study. *Cognitive, Affective, & Behavioral Neuroscience*, 17(4), 724– 736. doi:10.3758/s13415-017-0508-x
- Sweller, J., van Merriënboer, J.J.C., & Paas, F.G. (1998). Cognitive Architecture and Instructional Design. *Educational Psychology Review* 10, 251–296. doi:10.1023/A:1022193728205
- Sweller, J., van Merriënboer, J.J.C., & Paas, F.G. (2019). Cognitive Architecture and Instructional Design: 20 Years Later. *Educational Psychology Review*, 31(2), 261–292. doi:10.1007/s10648-019-09465-5
- Tewfik, G.L., Work, A.N., Shulman S.M., Discepola, P. (2020). Objective validation of YouTube™ educational videos for the instruction of regional anesthesia nerve blocks: a novel approach. *BMC Anesthesiology*, 20(1), 1-7. doi:10.1186/s12871-020-01084-w
- Thomson, F.C, Morrison, I., Watson, W.A. (2017). *Going Professional: using point-of-view filming to facilitate preparation for practice in final year medical students*. *BMJ Simul Technol Enhanc*

- Learn, 4, 147-149. doi:10.1136/bmjstel-2017-000224
- Ulmer, F., Lennertz, J., Greif, R., Bütikofer, L., Theiler, L., Riva, T. (2020). Emergency front of neck access in children: a new learning approach in a rabbit model. *British Journal of Anaesthesia*, 125(1), e61-e68. doi: 10.1016/j.bja.2019.11.002
- Wang, J., & Antonenko, P. (2017). Instructor presence in instructional video: Effects on visual attention, recall, and perceived learning. *Computers in Human Behavior*, 71, 79-89. doi: 10.1016/j.chb.2017.01.049
- Wilson, K. E., Martinez, M., Mills, C., D'Mello, S., Smilek, D., & Risko, E. F. (2018). Instructor presence effect: Liking does not always lead to learning. *Computers & Education*, 122, 205-220. doi: 10.1016/j.compedu.2018.03.011
- Yeap, Y-L., Randolph, T., Lemmon, A., Mann, M., Stewart, J., Wolfe, J.W. (2020). Effect of Prior Formal Education on Successful Thoracic Epidural Placement by Anesthesia Residents. *Journal of Cardiothoracic and Vascular Anesthesia*, 34(11), 3044-3048. doi: 10.1053/j.jvca.2020.06.023

JOURNAL OF e-LEARNING
AND KNOWLEDGE SOCIETY

www.je-lks.org

VOLUME 17 | ISSUE NO. 2 | DECEMBER 2021

**AN INTERNATIONAL AND OPEN ACCESS JOURNAL
BY THE ITALIAN E-LEARNING ASSOCIATION (SIE-L)**

www.sie-l.it

ISSN (online) 1971 - 8829 | ISSN (paper) 1826 - 6223