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Microlearning strategies for teacher professional development in the era of fourth industrial revolution in India

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Abstract

The Fourth Industrial Revolution which is characterized by rapid breakthroughs in digital technology, automation, and artificial intelligence, is revolutionizing both the classroom and workplace learning settings. This change in the classroom and workplace setting is characterized by changing skill requirements, accelerating knowledge obsolescence, need for personalized and adaptive learning experiences, a culture of continuous learning, and on-demand performance support. The educational landscape is changing with the intervention of technology into our lives and new and innovative ways of learning are emerging. The key stakeholders in the education system are teachers and their professional development has utmost significance in helping education pick pace with societal changes. The various strategies of microlearning are useful for teachers to enhance their skills and mitigate the impact fourth industrial revolution is having in terms of quicker knowledge obsolescence and new job creation. Microlearning can provide considerable benefits in the Indian classroom context since traditional educational systems struggle to keep up with these changes. According to a Deloitte University Press research report, microlearning can improve learning retention rates because it provides learners with bite-sized, focused content that is easier to digest and retain than lengthy classroom lectures or training sessions. The interactive and self-directed learning approaches, such as microlearning, can lead to higher learning outcomes compared to traditional classroom teaching (Sitzmann, 2011). The paper provides a look into effective microlearning strategies that can help in dealing with the problems of the traditional classrooms in the current digital society.

KEYWORDS: Microlearning, Fourth Industrial Revolution, Continuous Learning, Professional Development.

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1. Introduction

The fourth industrial revolution has permeated has permeated into our lives bridging the gap between the physical, biological and the digital worlds and it is changing the way we live, learn and work (Schwab, 2017). The Fourth Industrial Revolution, characterized by rapid technological innovation, automation, and digitization, is revolutionizing many parts of our society, including the economy, labor, and daily life. The Fourth Industrial Revolution is altering the work market, and the scale of impending skill set disruption is so large that the existing subject knowledge of the current workforce will be outdated in just a few years (Leopold et al., 2016). The scale is disruption is such that 65% of children enrolled in current elementary schools will ultimately end up working in completely new job types that don't yet exist (Leopold et al., 2016). The Fourth Industrial Revolution's rapid rate of technological improvement is causing knowledge obsolescence, in which skills and knowledge become swiftly obsolete. The markets generated by the fourth industrial revolution demand knowledge workers who produce goods and services with their mind (Xu et al., 2018). The traditional classroom learning may fail to keep up with these shifting skill demands as it equips learners for a static world that has ceased to exist and so the traditional content-based curricula must be replaced with fast-paced processes of knowledge creation (Doucet et al., 2018). The role of teachers in fourth industrial revolution is crucial in preparing

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students for the workplace of the future by cultivating their curiosity, collaboration and critical thinking skills (Doucet et al., 2018). These rapid advancements necessitate a continuous evaluation of the instructional approaches that will equip students for an uncertain future (Matthews et al., 2021). Thus, continuous teacher professional development is necessary to help teachers in inculcating key critical skills among learners that they require to navigate their way through the fourth industrial revolution (Ajani, 2021). To do so, teachers require to continuous upskill themselves in both content and skill. Microcontent and microlearning, offer a potential solution to rapidly developing and multitask-oriented patterns of learning and working that have emerged as a result of fourth industrial revolution (Buchem & Hamelmann, 2010). Buchem and Hamelmann (2010) emphasize that microlearning supports self-directed professional development for the teachers as it enables them to remain up-to-date in today's knowledge society by reducing knowledge gaps and building confidence in performing tasks. Microlearning is the process of learning through short, digestible, well-organized units of the content (Sonawane & Jadhav, 2022).

The concept of microlearning is based on the principles of spaced learning (Ebbinghaus, 1964) and distributed learning (Youtz, 1941). The distributed learning (DL) outperforms massed learning (ML) in terms of mnemonic advantage (Cepeda et al., 2006; Janiszewski et al., 2003). In two tests performed by Litman and Davachi (2008) it was found that over a 24-hour period, DL does not improve immediate memory performance but rather lowers the pace of forgetting compared to ML. Donovan & Radosevich (1999) investigated the relationship between massed and spaced practice circumstances and task performance and found that spaced practice led to better task performance. Concerning the use of microlearning for teacher professional development it was found that all teachers who used microlearning showed sustained professional learning (Billings & Kasmer, 2015). Furthermore, Kohnke and Foung (2023) found that teachers felt the microlearning teacher professional development activities to be quick, relevant, and engaging and were helpful in gaining practical knowledge and confidence.

Besides, Carter and Youssef-Morgan (2022) found that it appears that micro-learning yields the steepest immediate post-intervention results in comparison to traditional and online face to face learning. Furthermore, the imminent effectiveness of microlearning for teacher professional development can't go unnoticed. Microlearning helps teachers upskill themselves with tools that are already familiar to them in terms of access, curation, development and content; microlearning helps teachers learn from subject matter experts in comfort of their homes and also helps them engage with larger teacher community; microlearning provides teachers with means of active learning quickly in less time using devices they have while keeping records of their progress (Allela et al., 2020).

Looking at the search results that came up with key words "teacher professional development and microlearning" on google scholar, it can be seen that the use of microlearning by teachers to upskill in themselves has increased.

Microlearning is compatible with modern communication and information transmission methods. Microlearning can aid learners with brief, targeted, and easily available learning modules that can be swiftly updated to reflect the most recent technological breakthroughs, allowing learners to gain relevant skills in a timely manner. The necessity for personalized and adaptive learning experiences for teacher professional development is emphasized by the Fourth Industrial Revolution. Formal teacher training, which frequently takes a one-size-fits-all approach, may struggle to satisfy learners' individualized learning needs. Microlearning can deliver personalized and self-paced learning experiences that respond to each learner's particular learning styles, preferences, and speed, hence increasing learning effectiveness and engagement (Sonawane & Jadhav, 2022).

The classroom learning and professional development are most important factors in the life of the teacher. A successful teacher is eager to implement new ways of professional development and is keen to engage is outcome-based learning (Sonawane & Jadhav, 2022). Microlearning can create a lifelong learning mindset by providing conveniently accessible and convenient learning opportunities that fit into employees' hectic work schedules. This mindset towards learning in the life of the teacher leads to the successful profession and they unintentionally engage in continuous professional development, or we can say lifelong learning is leads to professional development also. It encourages individuals to take responsibility for their learning journey and supports self-directed learning, resulting in a workplace culture of continuous learning. The Fourth Industrial Revolution emphasizes the importance of on-demand workplace performance support. Employees frequently require quick access to information and resources in order to complete their responsibilities effectively. Microlearning can be used as a performance support tool by offering just-in-time knowledge, task aids, and micro-modules that employees can use as needed to assist their workplace performance, resulting in increased productivity and performance.

Teachers' professional development is a multifaceted process that involves development of various areas. Clarke and Hollingsworth (2002) provide an interconnected model of teacher professional development namely personal, practice, outcome and external source of information. A high-quality professional development program impacts teachers

content knowledge, is extended over a period of time, is collaborative in nature and is a part of daily work, is ongoing, coherent and integrated with teachers teaching objectives and goals for professional development, is inquiry based and teacher-driven (Kedzior & Fifield, 2004). Microlearning characteristically being user-driver and on-demand can cater to all the characteristics of a high-quality professional development tool. Besides, it has been seen that in comparison to traditional groups, microlearning group showed around 18% better learning outcomes (Sirwan et al., 2018).

However, there is still very less information on how teachers can use microlearning strategies to upskill themselves and what are the challenges they face. Thus, the paper aims to assess the status of teachers' use of microlearning strategies for professional development. Furthermore, the paper aims to map the challenges of using microlearning for professional development and suggest techniques that can increase the effectiveness of using microlearning for professional development.

2. Methods and materials

2.1 Methods

In the present study, mix method was used. To know the status of us of microlearning by teachers for professional development, survey was used. The survey method helps gather information from a large number of users. It assesses the characteristics of whole population of people or situations. Survey represents one of the most common types of quantitative, social science research. In this survey research, the researcher selects a sample of respondent from population and administer questionnaire to them for knowing the actual status. At the same time, researcher used open ended questions for getting deeper understanding and getting the information related challenges of the usages of microlearning for their professional development.

2.2 Instruments

The status of teachers' use of microlearning strategies for professional development was quantitative data was collected using "Microlearning strategies for professional development scale" which gave insights into the status of teachers' TPACK knowledge, proficiency in teaching skills, accountability, learnership effectiveness, and attitude towards self-upgrading using 78 statement Likert scale. The TPACK knowledge encompasses content knowledge, pedagogical knowledge, and technological knowledge. Content knowledge (CK) refers to the subject-matter expertise of the teachers. A given subject's concepts, theories, supporting data, and organizational frameworks may all be included in content knowledge, as well as the best practices and established methods for imparting this knowledge to students. The pedagogical knowledge (PK) describes teachers' knowledge of the practices, processes, and methods regarding teaching and learning. As a generic form of knowledge, it encompasses the purposes, values, and aims of education, and may apply to more specific areas including the understanding of student learning styles, classroom management skills, lesson planning, and assessments. Furthermore, technological knowledge describes teachers' knowledge of, and ability to use, various technologies, technological tools, and associated resources. Technological knowledge concerns understanding edtech, considering its possibilities for a specific subject area or classroom, learning to recognize when it will assist or impede learning, and continually learning and adapting to new technology offerings.

The proficiency in teaching skills component of the scale checks the status of the teacher's contextual proficiency, conceptual proficiency, and transactional proficiency. Contextual proficiency involves making learning meaningful to students by connecting it to the real world. It draws upon students' diverse skills, interests, experiences, and cultures and integrates these into what and how students learn and how they are assessed. Besides, conceptual proficiency involves the ability to verbalize connections among concepts and representations, conceptual understanding need not be explicit. The transactional proficiency involves teachers' skills in teaching various reading comprehension strategies and how to use them with each other.

The Accountability component of the scale checks teachers' measure of their accountability towards teaching, students, and administration. Accountability towards teaching includes teacher commitment to work for the highest standard of teaching and their adjustment in work along with punctuality. Teachers' accountability towards students includes providing equal opportunity to the students, demonstrating empathy, concern, honesty, and truthfulness towards students. It also encompasses teachers' belief that all children can learn. Teachers' accountability towards administration consists of being accountable to government or management, involved in community projects and extension service and providing service to the community through the professional.

Status of leadership effectiveness of teachers includes two kinds of leadership that the teachers can demonstrate namely, academic, and administrative. If a teacher uses academic leadership, they use four styles which include "telling, selling, participating and delegating" (Hersey & Blanchard, 1969). If a teacher is a successful administrative leader, they are able to establish systems that protect and sustain operational functions to meet the needs of children and families.

The status of teachers' rigor towards self-upgrading includes the frequency with which they participate in an extension course, workshops, conferences, and

seminars. The participation in the extension course covers teachers participating in refresher courses on related subjects, courses that talk about recent development in their courses, undertaking higher studies formal as well as through informal mode, ability to use computers for teaching and learning, and efforts towards developing technical skills as well as using various audio-visual aids for effective teaching. Participation in workshops, conferences and seminars in related subjects also includes getting involved into research activities, the reading of journals, reference books, books related to the subject as well as related to the subjects.

Furthermore, the teachers' cohort was invited to respond to open ended questions to talk about the challenges they face while using microlearning for their professional development. The questionnaire had five questions that talked about challenges of using microlearning, and if challenges faced by microlearning were in regard to a specific subject or were they generic, and the role technology can play in overcoming the challenges of using microlearning for professional development. Furthermore, teachers were asked about the benefits and drawbacks of using microlearning strategies for professional development and what are the best practices that teachers recommend for designing and delivering effective microlearning lessons.

2.3 Population

The target population were 32 school teachers of Kerala state in the age group 35 to 50 years of age. This group represents a section of teachers who are at the crux of the teaching learning process and are significant mitigators of the fourth industrial revolution. The teachers were part of the EDUREFORM Teacher training program at Kochi and were invited to participate in the research by filling the google form. The questionnaires were filled using google forms for the ease of the participants.

2.4 Data analysis

To assess the status of use of microlearning strategies for professional development for the teachers, we used descriptive statistics. The status of teachers TPACK knowledge, proficiency in teaching skills, effective use of leadership, accountability and self-upgradation was established by calculating mean and standard deviation of group. Furthermore, the data was graphed and skewness and kurtosis of the data was found.

Furthermore, the thematic analysis of the qualitative data was conducted to understand the common concerns shared by the teachers in regard to challenges, subject-specific difficulties, benefits and drawbacks of using microlearning for professional development and solutions that they suggest.

3. Results

The data was divided into five components namely TPACK knowledge, proficiency in teaching skills, effective use of leadership, accountability and self-upgradation. The mean of and standard deviation for each component was calculated. It was found that of all the participants It was found that the TPACK knowledge, i.e., knowledge of subject matter, technology and pedagogical knowledge of the teachers was average. Similarly, their proficiency in teaching skills, effectiveness of leadership, and rigor towards self-upgradation was average. This shows that even though teachers have content knowledge, technology and pedagogical knowledge to use Microlearning for professional development, they are not able to use it to the fullest due to some barriers. Similarly, they seem to use microlearning in improving their proficiency in teaching skills, leadership and for self-upgradation, there is still scope for improvement. However, their accountability was low which shows that teachers feel less accountable towards their profession, students and administration in respect to using microlearning for professional development.

Sr. No.	Component	Mean	SD	Interpretation
1.	TPACK Knowledge	47.09	4.49	Average
2.	Proficiency in Teaching Skills	45.75	4.48	Average
3.	Accountability	37.31	4.95	Low
4.	Leadership Effectiveness	57.68	4.61	Average
5.	Self-Upgradation	38.43	4.79	Average
	Total	226.28	17.86	Average

Table 1 - Mean and SD of Microlearning regarding Professional Development.

However, the data reflects that although microlearning have been proven as an effective model for professional development (Zhang & West, 2020), overall, teachers have been using microlearning for professional development to a moderate level. Furthermore, the learning area in which teachers use microlearning least in the area of accountability. The overview of the survey shown that teachers are low in the accountability. The teacher accountability is important as it provides intrinsic motivation to teachers to indulge in self-directed learning. The various strategies of microlearning may be the way to enhance the accountability in their profession.

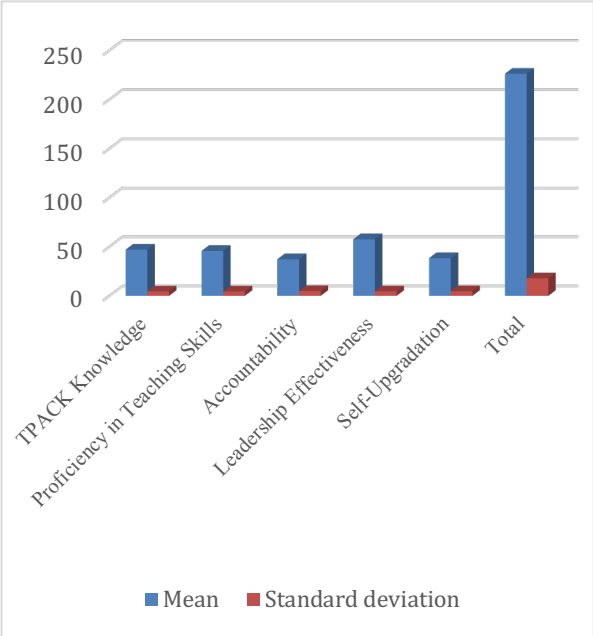

Figure 1 - Status of Microlearning for Professional Development.

In regard to challenges faced by teachers in using microlearning strategies for professional development, we found that teachers had problems paying attention to content being learned, they struggled in learning due to lack of face-to-face interaction with teacher and peer and lack of instant feedback with non-verbal cues from the learner while teaching and teacher while learning. The teachers also faced problems with managing time while using microlearning. There was a lack of motivation among teachers to use microlearning for their professional development. Besides, lack of digital literacy gadgets, and technical issues were also found to hinder the teachers' use of microlearning for professional development.

Furthermore, it was found that teachers find it difficult to use microlearning for subjects like mathematics [to learn/teach numerical], science [due to its practical component], dance, geography and history. Besides, they found it difficult to use microlearning to improve their skill of class management and interaction with the children.

Additionally, teachers found that if technology is used in microlearning it can make the concepts more digestible, can save time, improve attention, make it more attractive for students to pay attention, improve communication, create blended learning environments, and simulation to learn experiments.

Teachers found that using microlearning can have both benefits and drawbacks. The benefits listed by the teachers include that it makes learning user-centric, flexible, can be used to learn in portions, convenient, can be used to learn anything in world, low cost, can be done from anywhere even in the comfort of home, more exposure to different experts in the field, enhances self-discipline, can be used while not being a full-time student, and accessible. In terms, of drawbacks of using microlearning, teachers cited that it creates isolation and lack of confidence, increased screen time, more time-taking, can be distracting if the user is addicted to using gadgets for games and social media, can take more time than regular classes, can create health issues, and lack of socialization, cannot be used for practical learning, lack of individual attention, lack of peer interaction, lack of trust between teachers and students, can lead to addiction to gadgets, and student attention cannot be confirmed.

Regarding the best practices that teachers suggest for making microlearning more effective for professional development are better time management by instructors. Sessions should be more interactive and should include live creative work, the modules should have activities based on the topics covered, should collect feedback and improve, instructors should have recorded lessons and live sessions, the lesions should be well planned, should have YouTube videos, have group discussion forums for peer and collaborative learning, should be one source, should be flexible, instructor should check responses whenever possible, inclusion of activity based learning, learning should be visual with presentation and videos and should help interest in the subjects.

4. Discussion

Teacher professional development helps improve the education system and prepares them for the jobs of the future while enhancing students learning outcomes. The National Commission on Teachers (1983) pointed out the need for teacher trainers to be proficient in the use of skills they seek to develop among their trainees. In the era of 4th Industrial Revolution, the role of teacher is quite different, they should be constantly updating their Technological, Pedagogical, and Content Knowledge (TPACK) for their professional development. It means that teachers should have average knowledge and skills needed to effectively integrate technology into their teaching practices. In the age of Artificial Intelligence, the teachers should have a outlook of a learner so that can help their already techno-savvy students achieve necessary skills using multimedia and various educational gadgets. Teachers must be life-long learners and must strive to inculcate the need for life-long learning among their students. Teachers can mitigate the impact of fourth industrial revolution on the society with improved TPACK knowledge. Similarly, their proficiency in teaching skills is moderate. The Program of Action (1992) emphasizes that induction and continuing training programs for the teacher of District Institutes for Education and Training (DIETs)/ Colleges of Teachers Education (CTEs)/State Council of Educational

Research and Training (SCERTs) should be planned and implemented by National Council of Educational Research and Training (NCERT), The National Institute of Educational Planning and Administration (NIEPA) and other sister institutes. Therefore, the teaching skills with technology should be modified for the future learner. However, the accountability of teachers towards teaching, students and administration stands low which means that teachers do not feel accountable to use microlearning strategies to upgrade themselves due to obligation. Teachers are the brain and central nervous system of the education institutes establishment. Thus, the current teacher must use professional development tools that the current society has made handy.

Looking at the challenges teachers face in using microlearning for professional development, it is evident that one of the most common themes that was apparent in challenges teachers faced in using microlearning for professional development was time-management. This shows that the microlearning modules available for professional development are not following the thumb-rule being of 2-10 minutes in length. Besides, the teachers face the lack of face-to-face interaction and instant feedback from the instructor while learning. Moreover, teachers feel that microlearning modules should integrate simulation for practical subjects. These points emphasize that microlearning modules to be more effective for teacher use for professional development should be shorter, should have interactive features like annotation, discussion forums, should integrate URLs for sites that make simulation of practical subjects like mathematics and science possible, should also provide links to extra reference for teachers to refer if they want to. Moreover, even though discussion forums seem to be present in the microlearning environments, they are not active. So, for microlearning to be more motivating for teachers, the instructors of the course once in a while can host live online sessions and can interact in the discussion forums. Besides, the need to blend microlearning with in-person teacher professional development programs is also apparent from participant responses. Researchers suggest that microlearning, aligned with formal learning and embedded in online learning communities has the potential to support ongoing professional development (Buchem & Hamelmann, 2010). This will help teachers talk about their self-directed learning goals and issues that they face in achieving them and will help them seek support and guidance that they require. Additionally, teachers feel that feedback about the microlearning modules should be collected from them and the feedback should be integrated to make the modules better. This is an important component when thinking about the use of microlearning for professional development. Zhang and West (2020) emphasize that microlearning can be a powerful model for professional development if design is appropriate.

If the microlearning modules are improved on the basis of the feedback from the participants, they will be more relevant in terms of content and more contextual to the need of the participants they are targeted at. This will help improve the status of use of microlearning by teachers for professional development.

Besides, Hanshaw and Hanson (2019) have shown that microlearning can be developed into a more systematic tool for professional development by integrating it with social learning. This emphasizes the role of online communities and discussion forums in reinforcing teacher learning through microlearning by giving them platform to discuss and extend their learnings.

5. Conclusion

Professional development is generally associated with fixed guidelines of higher authority and deals with teacher effectiveness and attitude of teacher (Henwood & Flinton, 2012). Effective professional development is on-going process; it includes training, practice and feedback, and provides adequate time and follow-up support.

In the fourth industrial revolution, where knowledge creation happens at a very fast rate, teachers need to keep up with change teacher by constantly upskilling themselves. Besides, this continuous professional development of teachers will enable them to meet the learning needs of the current learner who due to high interaction with the digital systems have lowered their attention span (Microsoft, 2-15). To do so, teachers need to continually upgrade their content, pedagogy and technological knowledge with help of available resources online. Microlearning is an effective tool that can cater the need of the teacher for on-demand continuous professional development. However, the microlearning environments need to be improved to encourage teachers to use them. For this purpose, it is important to make microlearning environments that are available online conducive to the needs of the teachers. Integration of user feedback in to improve microlearning content and integration of social learning with microlearning are the ways ahead. Moreover, a successful microlearning program should involve teacher in learning activities that are similar to ones they will use with their students, and encourage the development of teacher's learning communities. The world is changing, old jobs are disappearing and new jobs are surfacing. Our students are walking into an uncertain future and to prepare them for future, we need to prepare their teachers for engaging in self-directed continuous professional development.

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