

# SCUOLAVISIONE: TEACHING AND LEARNING WITH HYPERVIDEOS IN THE SWISS VOCATIONAL SYSTEM

**Alberto Cattaneo**  
**Anh Thu Nguyen**  
**Florinda Sauli**  
**Carmela Aprea**

Swiss Federal Institute for Vocational Education and Training,  
SFIVET

{alberto.cattaneo, anhthu.nguyen, florinda.sauli, carmela.aprea}@  
iuffp-svizzera.ch

**Keywords:** hypervideo, interactive video, vocational education, instructional scenarios, acceptance

The study presented here is part of 'Scuolavisione', a project supported by the State Secretariat for Education, Research and Innovation (SERI) [project #08-756b] and by the Vocational Education and Training Division of the Canton of Ticino, which commissioned its development to the Swiss Federal Institute of Vocational Education and Training (SFIVET). The project has also been conducted in conjunction with Radiotelevisione svizzera di lingua italiana (RSI), which is an enterprise unit of the Swiss Public Broadcasting Company SSR SRG.

for citations:

Cattaneo A., Nguyen A.T., Sauli F., Aprea C. (2015), *Scuolavisione: teaching-and-learning with hypervideos in the Swiss Vocational system*, Journal of e-Learning and Knowledge Society, v.11, n.2, 27-47. ISSN: 1826-6223, e-ISSN:1971-8829

## 1 Introduction

In this paper, we will describe our attempts to exploit the potential of video-based multimedia, particularly in the form of hypervideos, to make teaching and learning as motivational—but, at the same time, effective—as possible.

Of course, this is a very ambitious aim. Currently, many scholars, teachers and educators are discussing the cognitive, behavioural and cultural changes brought about by Information and Communication Technologies (ICTs), continuing a discussion that started long ago. To cite a few major examples, there is the significant issue highlighted by Marshall McLuhan (1962; 1864) regarding how the means used for communication affect societies and people even more than the information contained in such communication. Similarly, Walter Ong (1958; 1982) addressed the way in which technology—whether writing, printing, or using the computer—directly contributes to (re-)structuring the ways people think. Following this line of thinking, more than twenty years ago, in examining the evolution of mankind and the shaping role of technologies in its cognitive development, Derrick De Kerckhove (1991) explored the different brainframes (distinguishing between the impact of television and that of the computer) that determine how we perceive the world. Pierre Lévy (1994) focused on the transformations that technologies ignite at a social level, as well as on concepts like “collective intelligence” and “inter-brainframes” (Riva & Galimberti, 1998). In recent years, other labels for referring to actual generations have arisen, suggesting that ICT has contributed to building a strong identity trait and distinguishing characteristics among young people. Thus, we habitually speak about a “Net-generation” (Tapscott, 1998), “homo zappiens” (Veen, 2002; Veen & Vrakking, 2006), and “digital natives” (Prensky, 2001a; 2001b).

In this framework, which still goes on to divide technology users, in turn, into enthusiasts and detractors (see *inter alia* Longo, 2001; 2003; Carr, 2010; Rivoltella, 2012), what is often highlighted is a double fascination: first, an interest in interactivity and hypertextuality and, second, an interest in the fact that images—both in the static form of pictures and in the dynamic form of videos—can play a specific role in capturing attention. The attractiveness of the visual channel is high, and it seems to be even higher with younger subjects.

Against this background, the question is whether and how the charm and attractiveness of ICT can be exploited to support and favour learning. Is there a way to use these potentialities in the fields of education and training? In which conditions is it possible to use videos for promoting learning? How can one produce multimedia materials capable of reaching this goal?

Questions like these are still open, and the pioneering work done by Richard E. Mayer (*inter alia* Clark & Meyer, 2003; Mayer, 1996; 2005; Mayer & Mo-

reno, 2003) on how learners process multimedia information and interactive tools is still the object of continuous analysis. In particular, there is interest in the work's three main theoretical lines of argumentation, as suggested by cognitive research: 1) dual coding/channel assumptions (Paivio, 1971; 1986), 2) cognitive load theory (Sweller, 1988; 2011) and 3) constructivist learning theories (Mayer, 1996; Wittrock, 1990). The second line of research is especially worthy of attention when speaking about videos in education, since the risk of cognitive overload should not be underestimated. However, in this article, our aim is not to enter into the details of such complex theories, nor to repeat the history of an interesting and still very real debate. Instead, we wish only to adopt a realistic view of multimedia that is neither undiscerning nor indiscriminately enthusiastic and neither apocalyptic nor resistant. Each solution has to be contextualized, and an optimal path cannot be chosen without taking into account the characteristics of the environment in which the solution will be enacted.

In our case this, is an important point of focus, as we are active in Vocational Education and Training (VET). In this context, learning resources based on video can be a very useful tool for showing, for example, concrete, real and authentic professional situations to apprentices, as well as for asking them to capture such situations. In Switzerland, in fact, the VET system is based on a dual track similar to that used in Germany and Austria, which is primarily organised in terms of an alternation between work-based and school-based learning. Depending on the profession, apprentices spend three to four days in a company (at which they have signed a regular contract and get paid) and spend the rest of the week at school, where they are exposed to general subject matters and to more theoretical aspects tied to professional knowledge. An additional third learning location is foreseen, as well: training segments, which are known as “intercompany courses” or “industry courses”, which last about fifteen days per semester and which are organized by specific occupational organisations. These are conceived as ‘complement[s] to the work-based and school-based segments’ (Swiss Confederation VPETA, art.16, par.c).

In this context, videos can be used by apprentices to capture or reproduce professional situations, based upon which a teacher at the vocational school can plan learning activities in order to foster the link between theory and practice, abstract and practical knowledge, and thinking and acting. Moreover, videos favour learning across sites through processes like, for example, reflecting, sharing and comparing.

Against this landscape stands Scuolavisione, a research and development project that develops a system for the design and creation of learning resources that combine videos and hyperlinked materials (i.e., hypervideos) and that promotes the use of authentic workplace situations, as well as television pro-

grammes.

In the following sections, we will describe the main components of the system, presenting its technological infrastructure and the corresponding theoretical grounding of hypervideos. Then, we will present a short illustrative selection of the first experiences conducted by teachers in the pilot phase of the project, which ended in June 2014. We will group these experiences according to the instructional use the teachers made of the resources. Finally, we will focus on questions related to the acceptance of the technological tools (i.e., ease of use and perceived usefulness) by both apprentices and teachers.

## 2 Scuolavisione: Hypervideos on the stage

The ability of images to play interesting and motivating roles in school contexts is surely not at all new, and schools have, of course, already tried to exploit these potentialities, with varied results (see, for example, the emblematic study by Hobbs, 2006). The same holds true with respect to multimedia—and, in particular, to the use of hyperlinks in order to reproduce a networked rather than a linear logic. But what happens if we try to integrate these two possibilities in a single solution? How is it possible to integrate visual materials in learning activities, while fully and simultaneously exploiting the potentialities of multimedia support? How can such resources be integrated in an effective way into learning activities at school?

These and similar questions were the starting point of Scuolavisione. As already mentioned, Scuolavisione is a project based on the hypervideo concept (Chambel *et al.*, 2006; Cherrett *et al.*, 2009; Zahn, Barquero & Schwan, 2004). The basic idea behind a hypervideo is rather simple: to apply the hyperlink concept to videos. In contrast to hypertexts or traditional multimedia, in which the role of a video can be purely illustrative or even optional, in a hypervideo, the ‘video’ component constitutes the starting point for all other references. In fact, a hypervideo, also referred to as an ‘interactive video’, is a hypermedium ‘that combines nonlinear information structuring and dynamic audio-visual information presentations (videos presenting realistic images or animations)’ (Stahl *et al.*, 2006, p. 286).

According to Zahn, Schwan, and Barquero (2002), three kinds of hypervideos can be distinguished. The first is a network of short videos that are linked to one another. The second is an existing linear film that is segmented into smaller scenes and indexed with respect to certain criteria or themes. For different themes, different scenes are rearranged and available to the user. Both of these kinds of hypervideos are defined as ‘homogeneous’, while the third is ‘heterogeneous’, as it combines different symbol systems, like texts, pictures, and graphics, linking them to the video. This third type is, then, a sort

of short film, linearly presented, but containing dynamic hypertextual links to additional information sources of various types. Scuolavisione makes use of this third type of hypervideo.

Additionally, interfaces like the one described in the next paragraph often integrate a video annotation feature that allows learners to take notes and share comments directly on the video (see, for example, Rich & Hannafin, 2009; Leijen *et al.*, 2009).

In addition to introducing complexity by inserting a temporal and networked dimension into pictures, a hypervideo has two main characteristics: 1) it is a representation tool that ‘can support self-regulated cognitive processing of dynamic visualizations’; and 2) as a ‘non-linear and interactive medium, it allows for reflective and elaborative knowledge acquisition, individually or in groups’ (Tiellet *et al.*, 2010, p.2).

The potentialities of hypervideo can be then identified as the following:

1. self-regulated interactive access to rich audiovisual information,
2. knowledge building and reflection activities through provided links among concepts, as well as the development of these concepts through the use of annotation (or cognitive map) tools,
3. interactions allowing debates, exchanges of views and information sharing.

It is exactly the combination of these potentialities that makes the interactive video a particularly interesting and potentially effective tool to support learning.

Scuolavisione seeks, then, to exploit the potential of hypervideos as a means of improving learning at Swiss VET schools by enabling all VET teachers, trainers and instructors, even those with limited computer skills, to create and personalise interactive audiovisual resources. Once created, these hypervideos can then be efficiently integrated and used in classroom activities.

Moreover, the project attempts to overcome one of the major problems related to the use of multimedia resources: many learning materials are produced by specialized commercial companies, but have no sustainable results in terms of impact. Despite the existence of good materials, such materials are often not used because they are perceived as being inflexible or incapable of responding to teachers’ (and students’) requirements. Scuolavisione seeks to give teachers (and trainers) willing to create customized learning materials the opportunity to benefit from a simple tool allowing them to (Cfr. Figure 1.):

1. select desired content,
2. insert such content in a light interface, which is easily usable without any special technical skill and is based on a completely graphical user interface (GUI; referred to as the “editor” or authoring tool) which will

- be used to transform simple videos into hypervideos (which will then be used in a “player”),
3. share the produced learning resources, placing them at the disposal of all their colleagues’ through a Web portal.

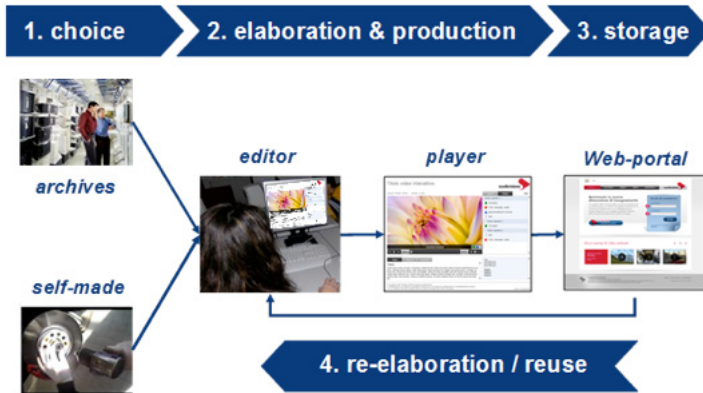


Fig. 1 - The complete architecture of the project

The selection of the video to be enriched—which we suggest should be as brief as possible, preferably no more than five minutes long—can be made through one of two main options:

- teachers may create the original videos themselves and/or involve students in the filming of sequences to capture real, professional experiences to work on at school; or
- teachers may draw from existing material.

The first option allows VET educators to teach students by exposing them to authentic occupational situations and by engaging them in the production of footage. This essentially reduces the gap among learning locations by constituting a functional bridge. It also allows VET teachers to work on the methodological, social and professional skills of students simultaneously, without unnaturally separating these knowledge areas.

A cooperation with *Radiotelevisione svizzera di lingua italiana* (RSI) has made the second option a viable one. In fact, thanks to this collaboration, VET teachers have the option to gain direct access to broadcasting archives (already active in the Italian-speaking part of Switzerland, under negotiation for other linguistic regions), which can then be used for education and training purposes.

The resulting hypervideos can be used both online (in a live-streaming mode) and offline (through a launch as a common file). Figure 2 shows the

main features of the interface: The primary portion (see point 1 in the figure) is dedicated to the video, which is identified in the upper-left corner by a title, the name of the author and the duration of the clip. On the right, one can surf the video using a menu (2), which segments the video into thematic units, as if they were “chapters”, depending on the content. Clicking on a specific chapter synchronizes the video to the corresponding scene. A small red rectangle tells the user the chapter in which she/he is. This menu can either display just the chapters or expand them for directly navigating the video through interactive points (2b). The clip can be made interactive by means of four types of “markers”, which a teacher can insert when designing a hypervideo and producing it using the editor: a blinking red point (3a) highlights details in the frame; a blue triangle focuses on a whole scene; and a green sheet of paper creates an assignment or a learning task. A fourth point, symbolized by a question mark, represents a “one-shot” quiz, which is a question related to the video to be answered (3b). Once the answer to the quiz is given, the user receives a feedback. Each of these points appears and disappears according to the scenes the designer wants to highlight.

Clicking any point activates a certain amount of widening (4), which can be constituted as downloadable documents of any format: through Web links, through images or audio files printed directly over on the video, or through brief texts that appear at the bottom of the interface (5). This last area can be used in three different ways, depending on which tab is active. Besides the function already mentioned, the “Notes” tab can be used to take notes, as a normal notepad, or—if using the hypervideo in a live streaming mode—for the online tagging of video, for the adding of posts and (related) replies (like comments in a weblog). Notes and posts can be exported in .pdf format for future reference; in this case, each page of the .pdf file contains the image, along with the frame of the video to which the notes refer.

Finally, it is worth mentioning that, when the player is launched, a pop-up window is displayed upon the video itself. This window contains any general instructions a teacher wants to provide to learners on how to use the video, what to do with the video, and the video’s purpose(s). The window can be hidden and shown again using the corresponding icon (6), so that the learners always have it at their disposal.





Fig. 2 - The player interface and its main characteristics

All of the hypervideos are collected in an online repository (a Web portal; see Figure 3), where it is possible to share them, given that copyright laws are respected. Any actor involved in VET (e.g., teachers, instructors, in-company trainers, exam experts, representatives of corporate associations) can subscribe the service completely for free. When creating a user id, an applicant has to sign an agreement, in which she/he is mainly asked 1. to personally take responsibility for ensuring that copyright laws are respected (if using existing videos); 2. to renounce any copyright proceeds (if using self-made videos); 3. to be willing to share any materials produced with the VET educational community; and 4. to ensure that she/he will only use the hypervideos for training and teaching in VET, and in no way for personal profit in or out of the VET system. Once teachers have registered with the portal, they will then be able to search for existing resources, not only to reuse them as they are, but also to adjust and re-structure them for compliance with their own needs. The portal will also allow teachers to manage their classes, to create online sessions with their pupils and to give pupils the opportunity to comment and tagging hyper-videos while streaming them.



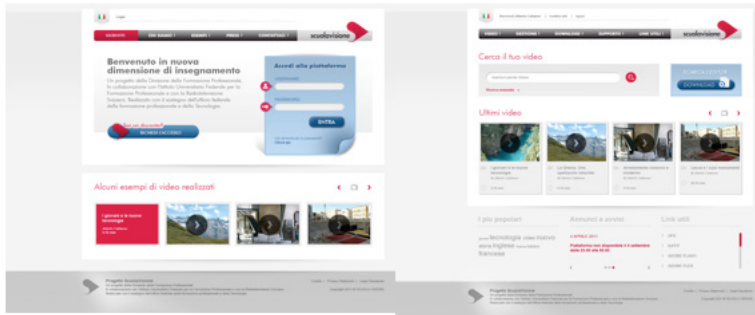


Fig. 3 - The Web portal entry (left) and home page (right)

### 3 Pilot experiences in VET classroom contexts

In this section, we will provide a brief overview of the possible instructional uses of the hypervideo tool. By monitoring a group of teachers over the course of two school years, we can observe how hypervideos are inserted in teaching and learning activities in different classes (and different professions) within the VET field.

**Support for teaching.** Regardless of a video's origin, one of the most common approaches is to use hypervideos to support teaching in plenary sessions. The focus in this case is on content. This scenario allows the teacher to become confident with the tool(s), while, at the same time (given the teacher's position at the forefront of an innovative practice), maintaining control over the many process' many variables. The hypervideo is constructed directly by the teacher; moreover, it is controlled by the teacher during the lesson. This does not necessarily require a teacher-centered lecture, since apprentices can be easily involved in commenting on videos and/or providing their own opinions or experiences regarding what is being shown. This is often the case when a teacher asks students directly to provide footage for hypervideos, which entails the students video-recording professional situations experienced at the workplace. Such an option is particularly relevant in the vocational context, since it permits the editing together of several unique hypervideo pieces of recordings, all from different workplaces, which can then be compared to enactments of the same professional procedure in different contexts. This process is relevant for apprentices' competence and professional identity developments. For example, chef apprentices use this kind of material to learn how the same cooking method has different effects, depending on the goods cooked (e.g., glazing carrots is different than glazing shallots) or the workplace context (e.g., glazing carrots

for four people in a high-ranked restaurant is different than glazing carrots for 200 people in a company canteen), since tools, labor divisions, and norms can vary enormously.

The active points become particularly relevant in focusing apprentices' attention on the crucial points of a procedure, and they can provide additional information for relating theory and practice, abstract and concrete elements, and more.

Instructional experiences of this first kind are reported in the literature on hypervideos (*inter alia*, Chambel *et al.*, 2006), but also in the vocational context (Cattaneo & Aprea, 2014; Motta *et al.*, 2014).

**Individual use and support for reflection.** A second alternative for integrating hypervideos at school is an approach that allows apprentices to work individually on learning materials, thus exploiting the opportunity to explore videos at their own pace and to directly and personally control the hypervideos. In this second case, the teachers' attention when developing hypervideos must be devoted to the development of audio narration (which could be missing in the previous case, since it could be substituted by the teacher's speech). Beside an exploitation of the active points, this method is very often also combined with an exploitation of the annotation tool—or, at least, with some reflection activities. This was the case for sales clerk apprentices engaged in an intercompany course to be introduced to customers' consulting. They were invited to participate in a role-play that was video-recorded. They then viewed the resulting video individually, using the annotation tool to reflect on how to correctly perform the procedure, analysing errors, their causes, their consequences, and ways to anticipate or solve them (see Boldrini & Cattaneo, 2013; Cattaneo & Boldrini, 2015). The pdf file was then made functional during the debriefing phase, during which the instructor systematized the different pieces of knowledge stemming from the learners' experiences.

Approaches of this kind are often available in the literature (e.g., Merkt *et al.*, 2011; Schwan & Riempp, 2004), especially when the focus is on video annotation (e.g., in the literature on teacher training, see Rich & Hannafin, 2009; Maclean & White, 2007; Tripp & Rich, 2012).

**Learning by design, individually or in groups.** Though the tool was mainly conceived for teachers to use the editor to build instructional resources, a third, particularly interesting possibility to exploit the potential of hypervideos involves adopting a more generative approach: asking students to build hypervideos in learning-by-design activities. In these cases, a teacher may give students—either individually or in groups—the task of enriching a raw video (which may already exist or may be created on purpose) and transforming it

into a hypervideo. The focus in this case is not on the final product, but, rather, on the creative process and the choices the students have to make on the basis of reflection and analysis. For example, with a group of surgery room technicians, the teacher created four different groups to conduct the main steps of the same procedure and assigned each step to one group. The groups were asked to simulate the step, to video-record it, and to enrich the video with the necessary information to facilitate an understanding of both the “know-how and the “why” behind their behavior.

Experiences like these are relevant in the literature on hypervideos and can be found in, *inter alia*, Stahl *et al.* (2006); Zahn *et al.* (2012; 2010).

Generally, what we observed through monitoring the first experiences of teachers using Scuolavisione is that there is a progressive and gradual transition from what Smith and Ragan (1999) define as ‘supplative’ approaches to more ‘generative’ instructional approaches (i.e., from using hypervideos to support teaching to involving students more and more in the development of both the videos and the hypervideos). In some cases, these three different approaches were been combined and integrated in subsequent phases of the same pedagogical scenario, giving birth to new, complex and articulated ways of teaching and learning with hypervideos.

#### 4 A first look on acceptance

**Method.** During the pilot phase, we monitored a group of 13 teachers and 332 students who had used both the editor and the player to assess their acceptance of the tool. Motta, Cattaneo and Gurtner (2014) showed in detail the relation between acceptance and the concept of ‘usability in the large’, defined as ‘ease of use plus usefulness’ (Hartson, 1998, p. 103). From here, they built the rationale to refer to the Technology Acceptance Model (TAM; see Davis, 1989) and its further developments (McFarland & Hamilton, 2006; Venkatesh & Davis, 2000; Venkatesh *et al.*, 2003) in the context of validated scales that measure acceptance through the two main dimensions of perceived ease of use and perceived usefulness (six items each). Thus, using the same assumptions and further integrating elements from the USE questionnaire (Useful, Satisfaction, and Ease of use; seven items; Lund, 2001) to develop a measure for satisfaction, we involved teachers and apprentices by giving them questionnaires based on these models and dealing, respectively, with the editor and the player (with minor adaptations to fit the VET context). Since they were already used to this scale, for apprentices, we used a 5-point Likert scale (1=completely disagree; 5=completely agree), while, for teachers, we used a 7-point Likert scale (-3=completely disagree; +3=completely agree) in order to collect more

finely grained results.

We also collected 18 teacher interviews to develop a more flexible view of their opinions regarding the primary perceived added values of the tools.

**Acceptance of the editor tool.** Teachers found the editor useful and easy to use, and they were satisfied with the experience. With respect to the ease of use, the mean of the 6-item scale was positive ( $M=1.76$ ,  $SD=.49$ ), with teachers assigning the highest value to only the two items explicitly mentioning easiness (Learning to use the editor is easy:  $M=2.14$ ,  $SD=1.07$ ; The editor is easy to use:  $M=2.14$ ,  $SD=.69$ ). With regard to the perceived usefulness, the mean of the scale was a bit lower ( $M=1.62$ ;  $SD=.84$ ), due to the item concerning the time investment (The editor enables me to accomplish tasks more quickly:  $M=.29$ ;  $SD=1.25$ ). However, this item is compensated by the others, including, most of all, the item explicitly referencing effectiveness (The editor is useful for my job:  $M=2.43$ ,  $SD=.79$ ). The results for the scale related to satisfaction are similar, in the sense that the general mean is not particularly high ( $M=1.67$ ,  $SD=.80$ ) due to the two most extreme items being positive, but quite low (Using the editor is fantastic:  $M=1.00$ ,  $DS=.82$ ; I feel the need to use the editor:  $M=.57$ ,  $SD=1.81$ ). Not only is the direct item on personal satisfaction quite high (I am satisfied with the editor:  $M=2.29$ ;  $SD=1.11$ ), but the one regarding whether the teacher would recommend the tool to colleagues is even higher (I would recommend the use of the editor to a colleague:  $M=2.43$ ,  $SD=.78$ ).

**Acceptance of the player.** The results concerning the acceptance of the player will be presented with respect to the modality of use (plenary session,  $n=98$ ; individual use,  $n=234$ ). Generally speaking, the ease of use was judged very positively, with a mean of more than four points in both cases, and with generally (if not significantly) higher rates for individual use: That is, directly using the tool made the tool appear even easier to use than when others used it. The perceived usefulness is high as well, with mean values of 4.14 and 4.04, respectively, for individual and plenary use. Finally, with regard to satisfaction, the results showed the same high ratings as seen in the previous two dimensions, but with a generally opposite tendency: that is, the plenary mode was more satisfactory than the individual (respectively,  $M=4.17$  and  $M=4.07$ ). The high students' satisfaction is particularly mirrored by the fact that they would like to have other lessons with hypervideos ( $M_{\text{plenary}}=4.19$ ,  $M_{\text{individual}}=4.07$ ).

**Added values of hypervideos.** From the interviews with teachers, three groups of added values emerged, depending on whether the teachers referred to the tool's functionalities, to teaching or to learning. Here, we propose the

main elements that emerged. Each is also supported by quotations in Appendix 1, where, in parentheses, we specify the sector in which the teacher is active, distinguishing among craftsmen, industry, health and social care, commerce, and (general) culture.

*The tool* is appreciated because it allows a) the representation of abstract, inaccessible, unusual, or not directly performable realities and concepts; b) the exploitation of the potential for multiple representations for the same content; and c) video annotation.

The main added values of hypervideos for *teaching* are, on one hand, its usability and adjustability (i.e., for individual, plenary, or group use) with regard to differentiating lessons, introducing new topics, deepening topics or contextualizing them (i.e., to make them relevant with respect to various context). On the other hand, teachers appreciated its customizability and personalized learning activities (which allowed individual pacing).

*With respect to learners*, hypervideos seemed to teachers to have effects on their motivation, engagement and identification; on their participation in discussions (e.g., “contrast” cases); on their autonomy and self-regulated learning ability; on their learning performance; and, finally, on their ability to learn a method (with specific reference to a learning-by-design and analysis-of-practice experience).

Table 1 reframes these elements, distinguishing whether they refer simply to videos or specifically to hypervideos. At the same time, it attempts to make the underlying functionalities more explicit.

Table 1  
VIDEO- AND INTERACTIVE-VIDEO-ADDED VALUES, ACCORDING TO TEACHERS

	Teaching/Learning	Student	Tool
Video	Represent (see/show)	See/see again	Toolbar Multiple representation
Interactive	Focus the attention Deepen the content	Cognitive load	Interactive points Links
	Self-regulated learning Autonomy	Pacing Self-assessment Reflection / analysis	Toolbar Quiz Video annotation
	Varying instructional strategies Flexibility	Motivation Interest	Hypervideo... + <i>instructional strategy</i>

As an overview, there seem to be three founding elements on which a VET hypervideo pedagogy can be built:

1. to bring into school classes apprentices’ authentic workplace experiences

- (origin of the footage) and to work on them;
2. to allow and foster processes of reflection through the video annotation feature and/or through analysis activities, which can be individually or collectively managed (there is no direct relationship between the type of transmissive or supplantive strategy and the ability to integrate these analyses); and
  3. to favour access to both basic and fundamental information, to further and deeper knowledge, and to the links between concepts, exploiting active points and their supporting multiple representations.

To these, a final consideration has to be added, which is that hypervideo is recognized to provide, in itself, an added value, since it offers teachers a new kind of learning material that can be used to support both teaching and self-regulated learning.

## Conclusion

In this paper, we presented some pilot experiences acquired by vocational teachers through a hypervideo software provided via the project 'Scuolavisione'. These experiences showed different ways of introducing a tool like hypervideos into a learning scenario to support teaching, self-regulated individual learning, or collaborative learning by design. Regardless of the instructional strategy, the results suggest that the software already fulfils the first pre-requisite of acceptance, particularly in terms of perceived ease of use and usefulness, both relating to apprentices and teachers. Particularly in the field of vocational education, the hypervideos elicited interest related to, not only the possibility of concretely showing specific professional procedures (e.g., the unusual ones, the difficult ones, the ones in which an error could easily occur, etc.), but also identifying the links between theory and practice through active points and supporting individual and collaborative reflection processes through annotation tools.

In sum, the results suggest that the interactive video has significant potential to support the development of metacognitive skills. A first indication in this direction is given by the potential to have learners work on self-produced videos, in which the learners are immediately involved in producing the footage either during their workplace activities or by simulating professional procedures in protected learning environments (e.g., in labs at school, during inter-company courses, etc.). This gives learners the opportunity to concretely analyse their performance, which is a very important part of the vocational learning activity. This second step can be spontaneously achieved by involving the whole class (as shown in the more supplanted approaches) or by exploiting the video

annotation tool peculiar to the interactive video player, which is even more effective. Video annotation facilitates individual reflection on practices, thereby supporting ex-post monitoring and evaluating processes, as well as anticipatory ones. Promising results in this direction have already been collected in specific studies (see Cattaneo & Boldrini, 2015), which have also illustrated the importance of teachers giving apprentices focused rubrics or prompts to fulfil the analysis.

However, the current study was exploratory and descriptive in its nature, and in no way do we believe that its results are generalizable. Moreover, the heterogeneity of the different experiences makes it impossible to compare or contrast the collected data. Therefore, future research should identify, through more structured research designs, which instructional conditions are optimal for the design of hypervideos and hypervideo-based scenarios to be effective for learning and for the development of metacognitive skills and strategies. This would require taking into consideration the type of knowledge to be acquired, the complexity of the content, and the learners' profile. With respect to effectiveness, then, different kinds of learning outcomes, including the practical ability to perform the considered procedure, should be considered—especially when speaking about vocational education.

Given these limitations and possibilities for the future, the study showed a great variety and flexibility of the applications of hypervideos and the ways in which hypervideos can be implemented in real schools without obstructing curriculum proceedings of the curriculum, thereby revealing hypervideos as truly motivational tools worthy of further exploration for the benefits of both teaching and learning.

## Acknowledgements

We thank Gianni Moresi, Osvaldo Arrigo and Theo Maeusli for the engagement in supporting the project; all the teachers involved in the first experiences with our hypervideo prototype: without them, nothing of what reported here would have been possible; and of course the other team members and colleagues, Ivano Giussani, Manuel Mauri Brusa, Elisa Motta, Maria Grazia Talarico, Michel Tinelli, and all the others, with whom we share the results of the project.

## REFERENCES

---

- Boldrini, E., & Cattaneo, A. (2013), *Written identification of errors to learn professional procedures in VET*. *Journal of Vocational Education & Training*, 65(4), 525-542.
- Carr, N. (2010), *The Shallows: What the Internet Is Doing to Our Brains*. New York,



- NY: W. W. Norton & Company.
- Cattaneo, A., & Aprea, C. (2014), *Using technologies to integrate vocational learning in multiple contexts*. In V. C. X. Wang (Ed.), *Handbook of Research on Education and Technology in a Changing Society* (pp. 675-690). Hershey, PA: IGI-Global.
- Cattaneo, A., & Boldrini, E. (2015), «*You learn by your mistakes!*». Procedural learning through written analysis of errors on a video-recorded worked-out example. Paper submitted for publication.
- Chambel, T., Zahn, C., & Finke, M. (2006), *Hypervideo and Cognition: Designing Video-Based Hypermedia for Individual Learning and Collaborative Knowledge Building*. In E. Alkhalifa (Ed.), *Cognitively Informed Systems: Utilizing Practical Approaches to Enrich Information Presentation and Transfer* (pp. 26-49). Hershey PA - London: IGI Global - Idea Group Publishing.
- Cherrett, T., Wills, G., Price, J., Maynard, S., & Dror, I. E. (2009), *Making training more cognitively effective: Making videos interactive*. *British Journal of Educational Technology*, 40(6), 1124-1134.
- Clark, R. C., & Mayer, R. E. (2003), *E-learning and the Science of Instruction*. San Francisco: Pfeiffer.
- Davis, F. D. (1989), *Perceived usefulness, perceived ease of use, and user acceptance of information technology*. *MIS Quarterly*, 13(3), 319-340.
- De Kerckhove, D. (1991), *Brainframes: Technology, mind and business*: Bosch & Keuning.
- Hartson, H. R. (1998), *Human-computer interaction: Interdisciplinary roots and trends*. *Journal of Systems and Software*, 43(2), 103-118.
- Hilton, J., Johnson, A., Stein, J., & Wiley, D. A. (2010), *The Four R's of Openness and ALMS Analysis: Frameworks for Open Educational Resources*. *Open Learning: The Journal of Open and Distance Learning*. Accessed March 30th. <http://hdl.lib.byu.edu/1877/2133>.
- Hobbs, R. (2006), *Non-optimal uses of video in the classroom*. *Learning, Media and Technology*, 31(1), 35-50.
- Leijen, Ä., Lam, I., Wildschut, L., Simons, P. R.-J., & Admiraal, W. (2009), *Streaming video to enhance students' reflection in dance education*. *Computer & Education*, 52(1), 169-176.
- Lévy, P. (1994), *L'intelligence collectif [Collective intelligence]*. Paris: La Découverte.
- Longo, G. O. (2001), *Homo technologicus*. Roma: Meltemi Editore.
- Longo, G. O. (2003), *Il sionista. Prove di umanità futura*. Roma: Meltemi Editore.
- Lund, A. M. (2001), *Measuring usability with the USE questionnaire*. Accessed March, 30th, [http://www.stcsig.org/usability/newsletter/0110\\_measuring\\_with\\_use.html](http://www.stcsig.org/usability/newsletter/0110_measuring_with_use.html).
- Maclean, R., & White, S. (2007), *Video reflection and the formation of teacher identity in a team of pre-service and experienced teachers*. *Reflective Practice: International and Multidisciplinary Perspectives*, 8(1), 47-60.
- Mayer, R. E. (1996), *Learning strategies for making sense out of expository text: The SOI model for guiding three cognitive process in knowledge construction*. *Educational Psychology Review*, 8(4), 357-371.

- Mayer, R. E. (Ed.). (2005), *The Cambridge handbook of multimedia learning*. New York: Cambridge University Press.
- Mayer, R. E., & Moreno, R. (2003), *Nine ways to reduce cognitive load in multimedia learning*. *Educational Psychologist*, 38(1), 43-52.
- McFarland, D., & Hamilton, D. (2006), *Adding contextual specificity to the technology acceptance model*. *Computers in Human Behavior*, 22(3), 427-447.
- McLuhan, M. (1962), *The Gutenberg Galaxy: The making of typographic man*. Toronto, Canada: University of Toronto Press.
- McLuhan, M. (1964), *Understanding Media*. London: Routledge.
- Merkt, M., Weigand, S., Heier, A., & Schwan, S. (2011), *Learning with videos vs. learning with print: The role of interactive features*. *Learning and Instruction*, 21(6), 687-704.
- Motta, E., Cattaneo, A., & Gurtner, J.-L. (2014), *Mobile devices to bridge the gap in VET: ease of use and usefulness as indicators for their acceptance*. *Journal of Education and Training Studies*, 2(1), 165-179.
- Ong, W. J. (1958), *Ramus, Method, and the Decay of Dialogue: From the Art of Discourse to the Art of Reason*. Cambridge, MA: Harvard University Press.
- Ong, W. J. (1982), *Orality and Literacy. The Technologizing of the Word*. Ithaca, NY: Cornell University Press.
- Paivio, A. (1971), *Imagery and Verbal Processes*. New York: Holt, Rinehart and Winston.
- Paivio, A. (1986), *Mental representations: a dual coding approach*. Oxford: Oxford University Press.
- Prensky, M. (2001a), *Digital Natives, Digital Immigrants Part I*. *On the Horizon*, 9(5), 1-6.
- Prensky, M. (2001b), *Digital Natives, Digital Immigrants, Part II: Do They really Think differently? On the Horizon*, 9(6), 15-24.
- Rich, P., & Hannafin, M. (2009), *Video Annotation Tools: Technologies to Scaffold, Structure, and Transform Teacher Reflection*. *Journal of Teacher Education*, 60(1), 52-67.
- Riva, G., & Galimberti, C. (1998), *Interbrain Frame: Interaction and Cognition in Computer-Mediated Communication*. *CyberPsychology and Behavior*, 1(3), 295-309.
- Rivoltella, P. C. (2012), *Neurodidattica. Insegnare al cervello che apprende*. Milano: Raffaello Cortina.
- Schwan, S., & Riempp, R. (2004), *The cognitive benefits of interactive videos: learning to tie nautical knots*. *Learning and Instruction*, 14(3), 293-305.
- Sclater, N. (2011), *Open Educational Resources: Motivations, Logistics and Sustainability*. In N. F. Ferrer & J. M. Alfonso (Eds.), *Content Management for E-Learning* (pp. 179-193). New York: Springer
- Smith, P. L., & Ragan, T., J. (1999), *Instructional Design (2nd ed.)*. New York: John Wiley & Sons, Inc.
- Stahl, E., Finke, M., & Zahn, C. (2006), *Knowledge Acquisition by Hypervideo Design:*

- An Instructional Program for University Courses*. Journal of Educational Multimedia and Hypermedia, 15(3), 285-302.
- Stahl, E., Zahn, C., Schwan, S., & Finke, M. (2006), *Knowledge acquisition by designing hypervideos: Different roles of writing during courses of "new" media production*. In L. Van Waes, M. Leijten & C. M. Neuwirth (Eds.), *Writing and digital media* (pp. 77-88). Oxford: Elsevier.
- Sweller, J. (1988), *Cognitive load during problem solving: Effects on learning*. Cognitive Science, 12(2), 257-285.
- Sweller, J. (2011), *Cognitive Load Theory*. In J. P. Mestre & B. H. Ross (Eds.), *The Psychology of Learning and Motivation* (pp. 37-76). San Diego: Academic Press.
- Swiss Confederation. 2004, *Federal Act on Vocational and Professional Education and Training (VPETA)*. Accessed April 4. <http://www.admin.ch/ch/e/rs/4/412.10.en.pdf>
- Tapscott, D. (1998), *Growing Up Digital: The Rise of the Net Generation*. New York: McGraw-Hill.
- Tiellet, C. A. B., Pereira, A. G., Reategui, E. B., Lima, J. V., & Chambel, T. (2010), *Design and Evaluation of a Hypervideo Environment to Support Veterinary Surgery Learning*. Paper presented at the Proceedings of the 21st ACM conference on Hypertext and hypermedia, Toronto, Ontario, Canada.
- Tripp, T., & Rich, P. J. (2012), *The influence of video analysis on the process of teacher change*. Teaching and Teacher Education, 28(5), 728-739.
- Veen, W. (2002), *Celebrating Homo Zappiens: Adapting to new ways of learning using ICT*. Paper presented at the British Council's Learning for All in a global society seminar series: Seminar A.
- Veen, W., & Vrakking, B. (2006), *Homo Zappiens, Growing up in a Digital Age*. London: Network Continuum Education.
- Venkatesh, V., & Davis, F. D. (2000), *A theoretical extension of the technology acceptance model: four longitudinal field studies*. Management Science, 46(2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003), *User Acceptance of Information Technology: Toward a Unified View*. MIS Quarterly, 27(3), 425-478.
- Wiley, D. A. (2007). Open Education License Draft iterating toward openness. Accessed March 30th. <http://opencontent.org/blog/archives/355>.
- Wittrock, M. C. (1990), *Generative processes of comprehension*. Educational Psychologist, 24(4), 345-376.
- Zahn, C., Barquero, B., & Schwan, S. (2004), *Learning with hyperlinked videos - design criteria and efficient strategies for using audiovisual hypermedia*. Learning and Instruction, 14(3), 275-291.
- Zahn, C., Krauskopf, K., Hesse, F. W., & Pea, R. (2012). *How to improve collaborative learning with video tools in the classroom? Social vs. cognitive guidance for student teams*. Computer-Supported Collaborative Learning, 7(2), 259-284.
- Zahn, C., Pea, R., Hesse, F. W., & Rosen, J. (2010), *Comparing simple and advanced video tools as supports for complex collaborative design processes*. The Journal of the Learning Sciences, 19(3), 403-440.

Zahn, C., Schwan, S., & Barquero, B. (2002), *Authoring Hypervideos: Design for Learning and Learning by Design*. In R. Bromme & E. Stahl (Eds.), *Writing Hypertext and Learning. Conceptual and Empirical Approaches* (pp. 153-176). Oxford: Pergamon.

## APPENDIX 1: Added values of hypervideos, according to teachers

Value	Specification	Quotation
For teaching...	Usable and adjustable in different ways (individually, plenary, groups)...	«The positive aspect of such a video is that <b>you can use it in very different ways</b> . You can use it in the computer lab, interactively. You can use it in plenary sessions, you can use it in small pieces, you can use it as a group work. So, you can use it in many ways, <b>depending on who you are in front of</b> » (commerce)
	...to differentiate lessons	«Using this technological innovation also means <b>enrich the classroom teaching by combining</b> the lectures, the guided discussions, the group work and so on, with <b>this new mode of teaching and learning</b> » (culture)
	...to introduce new topics	«Because <b>even looking only once</b> at those five minutes we saw together, <b>the topic has already been introduced</b> » (culture)
	...to deepen existing topics	« <b>Interactive contents allow a deepening of what is said in the classroom during classes</b> » (art)
	...or to contextualize topics (to make them relevant to various scenarios)	« <b>Ready-made videos are never instructional</b> . [...] They take too many things for granted. Hence, they risk to cut off a large part of the population from the information, exactly because <b>they start from assumptions defined as absolute [...] so the teacher's task is precisely to be allowed to manipulate or resume this video</b> » (culture)
	Customised and personalised learning activities (with respect to individual pacing)	«The apprentices, at their own pace and according to their own motivations, face the chosen educational path, personally <b>investing time and energies for every single addition, regardless of the pace of the class. This in itself is a big news</b> . In class there are often situations where the weakest "slows down" the strongest or even where the strongest prevails on the pace to be given to a lecture. In this case we witness a <b>democratization of learning</b> » (culture)  «For example a student worked in a hospice, the technique was done in a certain way. The other student had maybe had an experience in a surgical ward, and had seen the same technique done in another way, and there was even a comparison. So <b>everyone brought his personal experience</b> » (health)

Value	Specification	Quotation
For learners' ...	Motivation,  engagement,  ...and identification	«It is the first year that I see a series of students sending me emails to ask for clarification on some details. It never happened in 15 years» (health)  «Individual work allowed those people who often do not intervene in the class because of shyness to express themselves and give examples on the contents of the lesson without fear» (culture)  «The actors were some of the students, and so this was a very positive thing because they self-motivated themselves. Then, both the aspect of preparing the video and of following the lesson, for those who then followed the video, it was an interesting job. So, for those who did it, it was interesting because they built, they were actors, they were very motivated, they were very well prepared. It was, for them, a matter of making them visible. It valued them. They took self-confidence, and for those who looked at them, then those classes that I used to explain, the fact that they saw their school-mates... it became an even more real thing. They were not strangers or in a foreign shop, so... but the fact of seeing a store that they knew and boys who they knew—or, at least, they knew they were apprentices—dit has been positive» (commerce)
	Incentives for participation and discussion ("contrast" cases)	«While in the morning there was little comparison, everyone did their own things and nothing else. In the afternoon, it was a fantastic thing—I mean, a real discussion. They commented things! Then, the video showed one thing—we've done it in another way. You can do it in one way... you can do it in another way... Does the result actually change, or...? Then, you have to go in depth» (health)
	Autonomy	«It promotes education to autonomy. The user is in front of the computer with headphones in his ears, and this being in front of a screen to "talk" with oneself is an unusual aspect for them: They find themselves in a kind of isolation from their peers and from the dynamics of the class, and they have to cope with assignments relying only on their own resources. There is always the possibility of appealing to the teacher, but, from what I could ascertain, the students come to him especially for technical issues, finding, in the potential to manage their own time and resources, a new, exciting challenge to which they are generally not accustomed» (culture)
	Performance	«When I put the video, all the guys were attentive, interested in the video, until it has stopped, and there were true/false questions. The ninety percent of the class was attentive and answered the questions correctly. This means that the video has hit much more than my lectures on the blackboard» (craft)  «"I've learned and I didn't even realized it!" exclaimed a boy at the end of the lesson. So, I had the proof that, for this student, the content of the lesson was better integrated and learnt through the use of this tool» (culture)
	Learning a method	«[...] from the methodological point of view, with this system, they have learned a method and used a method that they can reproduce everywhere. [...] The idea, the criterion, the method, the modality immediately became part of... because they have internalized it» (health)

Value	Specification	Quotation
Tool functionalities	Representation of abstract...	«The video, in this case, <b>explained the movement of the atoms, the electrons in a conductor. He added some moving dots. So, one says, "Ah, look, the electron is a dot that moves." [...] That's why I say it is easy, easier to understand: it is visible!</b> » (craft)
	inaccessible...	« <b>You do realize all that I told you, and you see it.</b> "Ah, now I understand what a blast furnace is, what the molten steel is. Because until now I have imagined... I saw some pictures, but, in fact, I have never seen it." [...] <b>If you see it, it helps.</b> Now you understand what it is, and, probably, you will remember it. Then, <b>you know the difference between the steel and the cast iron. If you do not see the video, then many of them will confuse it. I noticed that</b> » (craft)
	unusual...	«[...] In a manual profession like ours, you learn by observing, and having a video as a support, <b>especially for those processes which, as we said, are never or seldom executed,</b> is a great support in the sense of seeing. [...] <b>Additionally, you have the advantage of being able to insert these active points, while watching,</b> which can foster discussions, deepen the most important processes, etc.» (craft)
	...and not directly performable...	«it is a teaching tool that <b>allows the student to approach, reflect and learn a technique, a nursing skill, in contexts in which it wouldn't be experienced directly</b> or where the experimentation would already imply an implementation on a real patient» (health)
	...realities and concepts	
	Multiple representations	«The addition of further documents inside the video allows you to provide, at the same time, <b>additional representations of the same object or procedure.</b> For example, this allows you to <b>combine visual representations of iconic/theoretical-type and real-life situations</b> » (health)
Video annotation	It is an <b>excellent function to analyze professional practice and to promote students' activation, reflection and awareness,</b> since «it allows people who are carrying out the action to be able to review and evaluate their posture, the technique used, to identify difficulties and analyze the results obtained [...]», and observe aspects of «body, verbal and paraverbal language» (health)	