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Challenges 2019

Desafios da Inteligência Artificial

Artificial Intelligence Challenges

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SÍNTESE

Nota de Abertura

Challenges é uma palavra polissémica, escolhida para sintetizar o desafio e a aventura de erguer a primeira conferência de Tecnologias de Informação e Comunicação aplicadas à Educação, no remoto ano de 1999. Estávamos, então, em final de século e no início de uma nova fase da integração tecnológica nas escolas Portuguesas, especialmente através do programa Nónio Século XXI. Havíamos experimentado anteriormente um projeto de enorme sucesso - o MINERVA, que criou lastro para muitos sonhos e desafios às escolas, aos investigadores e, por consequência, às instituições que formavam professores. A Challenges de 1999 foi uma espécie de empreitada aventureira no ignoto mundo das Tecnologias de Informação e Comunicação, suportada por uma rede eclética de parceiros investigadores, entusiastas professores, adultos e crianças, afinal, os últimos e primeiros destinatários da Challenges.

Vinte anos depois, eis-nos praticamente no mesmo ponto do processo, explorando o desconhecido, teimando no incerto, desbravando os mesmos terrenos indefinidos que as escolas enfrentam com as tecnologias digitais. Ante a evolução tecnológica, e em vinte anos é tão avassaladora!, são infinitos os desafios, as conquistas e os retrocessos que ora nos parecem tolher os passos, ora nos impelem a avançar. Ainda assim, a Challenges chegou aos cinco continentes, considerando oradores convidados e investigadores participantes, firmando o seu estatuto de referência na promoção e divulgação da investigação e das práticas de TIC na Educação em Portugal e assumindo uma expressão verdadeiramente internacional, da Europa à Ásia, da África às Américas e à distante Austrália.

O mote central foi a Inteligência Artificial e os seus desafios na, e para, a Educação, um exercício real e provocatório da inteligência e das máquinas. Mas, será assim tão importante descortinar como é que as inteligências artificiais andam a desafiar as inteligências naturais? E, é esse um tema transcendente para a Educação no século XXI, preocupada que está com o pensamento e a codificação?

Foi a este desafio que aceitaram responder os conferencistas e os autores dos cerca de 140 textos submetidos. Passaram no crivo de qualidade da Comissão Científica 102 títulos, envolvendo cerca de 240 distintos autores, evidenciando a dimensão da rede de investigadores que a Challenges reúne. Se o desafio foi superado, só o leitor poderá concluir.

Organiza-se, este livro de atas, em três secções, correspondentes aos eixos temáticos da conferência.

Eixo I - Tecnologias, aplicações e sistemas emergentes

Neste eixo apelámos aos contributos que discutem a inovação no domínio das tecnologias digitais, com ênfase na Inteligência Artificial, nas suas múltiplas vertentes e dimensões e na sua articulação no horizonte de desenvolvimento das dimensões formal, informal e não-formal do ensino, da formação e da aprendizagem. Queríamos dar cobertura especial aos processos de ensino e aprendizagem, às tecnologias, aplicações e sistemas emergentes do avanço tecnológico e da inovação científico-pedagógica. São trinta os textos que procuram descortinar este eixo.

Eixo II – Recursos, práticas, currículo e políticas

Os contributos em torno da problemática da inovação curricular e pedagógica articulada com as tecnologias digitais e potencializada pela dimensão da Inteligência Artificial, no sentido do desenvolvimento do currículo nos diferentes contextos e ambientes de aprendizagem estão reunidos neste eixo. Abrange a aprendizagem ao longo da vida, a aprendizagem ubíqua e os ambientes e espaços flexíveis de aprendizagem que buscam adequação e eficácia na preparação de competências para o nosso tempo. São sessenta e quatro os textos agrupados nesta dimensão da Challenges.

Eixo III – Ética, gestão, financiamento, investigação e avaliação

Por fim, o terceiro eixo inclui diferentes dimensões da avaliação no âmbito das Tecnologias de Informação e Comunicação, com especial atenção aos vetores que integram Inteligência Artificial, *Learning Analytics* e *Big Data* como novas formas de abordagem. Integra aspetos relacionados com a usabilidade, a fiabilidade, a credibilidade e a eficácia da avaliação de recursos, sistemas e aprendizagens no quadro da sua realização com apoio em ambientes e ferramentas digitais. São apenas oito os textos incluídos neste eixo.

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Models for facilitation of teacher's professional development through video-supported collaborative learning

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Abstract: Video is a resource and a tool very often used in everyday life, through digital devices, applications and platforms such as YouTube, Instagram, Facebook and WhatsApp, among others. However, most teachers do not know how to use videos systematically in teaching. Most teachers do not use video tools in order to contribute to the development of conceptual thinking and problem-solving skills as relevant competencies to the working life of the knowledge worker. In the context of the VISUAL project, a systematic review of the literature focused on the theme of video-supported collaborative learning was carried out. From the results we have outlined for this presentation: the reasons, benefits and challenges of video-supported collaborative learning, the modalities of video usage in collaborative learning and knowledge building and models for professional development of teachers through video-supported collaborative learning.

Keywords: video-supported collaborative learning, models of teacher professional development.

Resumo: O vídeo é um recurso usado muito frequentemente na vida dos cidadãos, através de dispositivos digitais, aplicações e plataformas como Youtube, Instagram, Facebook e WhatsApp, entre outras. No entanto, muito professores não sabem usar vídeos sistematicamente no ensino. A maioria dos professores não usa ferramentas de vídeo de forma a contribuir para o desenvolvimento do pensamento conceptual e das habilidades de resolução de problemas como competências relevantes para a vida profissional do trabalhador do conhecimento. No âmbito do projeto VISUAL, foi realizada uma revisão sistemática da literatura centrada no uso do vídeo como suporte à aprendizagem colaborativa. Dos resultados obtidos destacamos: as modalidades de uso do vídeo como suporte à aprendizagem colaborativa e à construção do conhecimento e os modelos de uso do vídeo como suporte à aprendizagem colaborativa reportados na literatura e usados em processos de educação e desenvolvimento profissional dos professores.

Palavras-chave: aprendizagem colaborativa suportada no vídeo; formação e desenvolvimento profissional dos professores.

Introduction

The evolution of information and communication technologies (ICT) and video technologies in particular in recent years have had a major contribution for the so-called digital transformation, with impact in almost sectors of human life, as business and marketing, entertaining and gaming, education and training, between many others.

ICT in its many different technological forms and devices, tools, platforms and services have become part of daily life of many adults and youth in Europe and worldwide. Internet permanently connected allows us to communicate anytime and anywhere using Youtube, Face-book, Snapchat, WhatsApp and applications alike, most of it with embedded video tools.

Although some progresses can be observed, many schools, teachers, students and educational communities are still far away of these societal and technological changes. Previous analysis of the VISUAL ALLIANCE partners shows that most teachers do not use videos systematically in teaching.

But even when video technologies come into the educational systems (online / face-to-face) they are most of the times used to support traditional teaching models. A large proportion of these materials are content-based videos and were designed, produced and delivered for providing information, knowledge and contents for the individual consumer.

“Much of what is called educational video on these sites merely features educators talking. Although the value in watching the world’s most creative teachers discussing

their favorite subjects is undeniable, the scope of the video's potential in education ranges much wider than the mere transmission of lectures" (Bull & Bell, 2010).

This type of video is now populating a large number of web platforms adopting several for-mats as video lessons, course lessons (MOOC's platforms, YouTube, Vimeo, etc.), demonstrations, tutorials, screencast and other types of video for supporting content-based instruction.

The globalization and the almost "universal distribution" of mobile devices as tablets and smartphones are well equipped with video cameras with high resolution, make easily available in the hands of many people, video capabilities similar to professionals that make each individual with a smartphone, a real filmmaker, spreading his or her video projects over the internet and getting a significative number of views of thousands people, creating their own audiences.

These possibilities however are not enough, *de per si*, to find answers for the challenges of the education paradigm in 21st century societies. "Free collaboration does not systematically produce learning" (Dillembourg, 2002)

Although educational institutions as universities, institutes and schools but also corporations adopt and explore video technologies associated with communications' network capabilities, cloud storage, sharing tools and creating new pedagogical strategies to support video based collaborative learning between groups of people.

But still, there is a need to go further in the potential of video capabilities for collaborative learning and explore new educational possibilities of the digital video and online platforms, adopting new learning approaches, even when video technology affordances are not well suited for collaborative learning. "The lack of affordances for collaboration in these systems inhibits collaborative discussion and does not offer an engaging video experience." (Singh, Abdellahi, Maher, & Latulipe, 2016).

The lack of technological solutions but also of pedagogical approaches to support collaborative learning is a problem that must be addressed at a time when the collaborative skills are considered fundamental working life skills for those who live in 21 century.

However, efforts are being made to develop technological solutions to help solve this problem, including interactive video, annotation tools, collaboration tools and group work in online spaces associated with video as well as the creation of new approaches and pedagogical models that support these new developments.

The purpose of this article is to identify the state of the art in terms of solutions and pedagogical models with regard to video-supported collaborative learning in teacher education, professional learning and other educational contexts.

This literature review will serve to clarify how the state of the art in the field is and how will help to sustain the conception, experimentation and research of new proposals that allow a scientific advance with respect to video-supported collaborative learning models.

The main challenge of the research efforts is to understand how different ways of using video technologies and tools can be used and integrated into pedagogical models and educational perspectives as collaborative learning and knowledge building.

As a guide for the literature review one research question was formulated and is as follow:

How video technologies and tools have been used for supporting collaborative learning in order to facilitate professional development?

Video-supported collaborative learning is defined as the pedagogical strategies that institutions and individuals can create and adopt for developing conceptual thinking and problem-solving skills as relevant work-life competences of the knowledge worker, by using video technology, tools and platforms within different educational settings.

In the context of this study we also consider the meaning and understanding of collaborative learning proposed by Pierre Dillenbourg as “the broadest (but unsatisfactory) definition of 'collaborative learning' is that it is a situation in which two or more people learn or attempt to learn something together. Each element of this definition can be interpreted in different ways: a) "two or more" may be interpreted as a pair, a small group (3-5 subjects), a class (20-30 subjects), a community (a few hundreds or thousands of people), a society (several thou-sands or millions of people)... and all intermediate levels; b) "learn something" may be interpreted as "follow a course", "study course material", "perform learning activities such as problem solving", "learn from lifelong work practice"; c) "together" may be interpreted as different forms of interaction: face-to-face or computer- mediated, synchronous or not, frequent in time or not, whether it is a truly joint effort or whether the labor is divided in a systematic way (Dillenbourg,1999).

We underline the importance given to social interaction as a fundamental dimension of collaborative learning, no matter what is to be learned, the sample size or the medium used for social interaction. Social interactions that “focusing on the development of a common ground and shared knowledge. The two are formed through negotiation and knowledge exchange. This may be in a dialectic conversation of agreeing and disagreeing with messages, making your position known to group members, posting rejections to messages that are unintelligible or objectively incorrect in the eyes of someone else (...) (De Jong, 2015).

Method

This literature review followed systematic procedures for search and selection of the documents to be reviewed based on four main inclusion criteria: content, scientific quality process assurance of the articles to be selected and reviewed, language and chronological period.

In the content criteria, it included articles and chapters that explicitly are related to pedagogical models for facilitation of professional development via video-supported collaborative learning. Those articles that doesn't explicitly refers to that content was considered "off topic" and not included in this review. Also, content of the articles should mention and describe empirical research methods.

In terms of scientific quality process assurance of articles to be part of the corpus, this review accepted papers published in peer-reviewed scientific journals.

For the chronological period and language criteria, the following was adopted: the papers/ articles should have been published after 2003 and written in English language.

The documents search was limited to the following databases:

ERIC (available: https://eric.ed.gov)

Educational research complete (available: https://www.ebsco.com/products/research-databases/education-research-complete)

Psyndex (available: https://www.psyndex.de/index.php?wahl=PSYNDEX&uwahl=Angebot&lang=EN)

Psychinfo (available: https://www.ebsco.com/products/research-databases/psycinfo

For the research question above mentioned, the following search string was used: (((video) AND ((Collaborative learning) OR (collaboration)) AND ((professional development) OR (teacher education) OR (teacher training) OR (vocational education) OR (professional education))).

In terms of number of records of search query, results were as follow: # = 474 before discarding duplicates; # = 363 without duplicates.

A first reading of articles and considering the content criteria, a total of 263 papers were considered off topic and were excluded. A total number of 100 papers were listed and reviewed by research team members of VISUAL project.

In addition to the list of the articles resulting under the advanced query search carried out, only exceptional studies were considered in order to go through deeper knowledge on this issue.

Exploratory readings were made of all the records of the selected material by a team of re-searchers that were invited to collaborate in the literature review and his/her names and institution were included in the contributors list.

Results

A pre-determined group of categories (theory driven) but also emergent categories was used to aggregate similar information and related concepts and code the data and information for a preliminary quantitative and qualitative data analysis.

Where possible and appropriate, data and information were coded using numeric symbols for quantitative data analysis, using descriptive statistical processing in order to understand the main tendencies and data distribution of the reviewed studies. In this presentation we present a part of the qualitative results.

As there is a limitation on the number of pages to submit at this conference, only a small part of the results is presented and discussed in this paper.

In this context, findings from qualitative analysis of this review were organized in the following main topics: 1) modalities of video usage for collaborative learning; 2) pedagogical models of video-supported collaborative learning.

Modalities of video usage and video-supported collaborative learning

Modalities of video usage is a category created in the beginning of the study and it incorporates the initial matrix of analysis of the literature. It was one the lens through we look for literature review meaning and shows how video technologies was used to support collaborative learning.

In this literature review, involving 100 peer-reviewed papers, four ways of using video technologies to support collaborative learning were found.

All the modalities of video usage were reported to be used in research and allowed some kind of collaborative learning events, in the way video technology was used. We specify the content and the meaning of each of these types or modalities of video usage to support collaborative learning.

Video Recording

Video Recording: it refers to the use of video for capturing and recording images of educational events. In the studies where video recordings were used, evidences were collected on capturing and recording professional and teaching practices - for education, training and professional development purposes - through diverse types of activities, since observation, analysis, discussion, dialogue, sharing, giving feedback and reflections between peer and groups of people (teachers, students, trainer, trainees and others) using video recording from their own or other's practices. These types of studies show evidences of the use of video recordings of professional practices to support collaborative learning.

Creating videos

Creating videos: it refers to the processes of using video technologies and tools for capturing, creating, editing, publishing and sharing video for educational and training purposes.

A number of studies show evidences that creating and editing video is an enrichment process and was used to support collaborative learning, within students centered pedagogical perspectives where students became producers and collaborators.

Video content display and interactive/hypervideo

Video content display: it refers to using video for content delivery, from different sources and formats, and in some of that formats, it includes the using interactive tools or hypervideo navigations tools and video annotations tools.

The analysis of these studies shows evidences on how using video content has been an opportunity to promote different kinds of learning processes, as video supported instruction (Cattaneo, Van der Meij, Aprea, Sauli, & Zahn, 2018) but also social interactions and collaborative learning. In this sense, using video content is a resource for teaching/instructional purposes, video-based lessons, videos courses, video modules and other online digital video resources including other different types of videos as demonstrations, screen casting, live streaming videos and others. It can be used in a standalone format or embedded in an online platform for lessons and courses, for individual consumer or group and large-scale number of consumers.

Educational content videos – as films and documentaries or homemade video can be combining with other materials and embedded in some general pedagogical strategies in order to enhance students' learning.

This modality of video usage includes interactive video and hypervideo as these videos are in nature video-based content to be delivered to the users, although the content of an interactive video can support some kind of "manipulation" from its users and support active, constructive or interactive learning.

Video as a communication tool

Video as a communication tool: it refers to using video technology to communicate with others in asynchronous and synchronous interactions.

A number of studies explore video as communication tool in professional contexts, in particular in the field of teacher education. These studies reveal how teachers have been using video technologies to communicate with other teachers and students in asynchronous and synchronous interactions, including web-conference systems (Zoom, Skype, YouTube, social media) live video (video streaming) with social interactivity in real-time using verbal interactions, questioning/answering within participants, comments and feedback.

Literature review also show a certain number of papers that combines two or more modalities of usage of video technologies, e.g., an online fictitious video case scenario and a video resource in student's presentations.

Pedagogical models for facilitation of professional development via video-supported collaborative learning

In this literature review thirteen models were found where video was used to support collaborative learning for facilitation of professional development.

Model for supporting collaborative learning through teacher's video clubs

In this model, groups of teachers observe, discuss and reflect about each other's' classroom practice, regularly (Cockburn, 2010). Video clubs have been created to empower teachers through the promotion of teacher's reflections, observation and feedback (of their own and others video recording teaching practices), mentoring and coaching, sharing and collaborating within communities of practices and learning.

Video clubs has been also adopted as a strategy for developing pre-service teacher's knowledge of science (Johnson & Cotterman, 2015).

Research shows that participating in a video club was found to influence the teachers' professional vision as exhibited in the video club meetings, in interviews

outside of the video club meetings, and in the teachers' instructional practices (Sherin & Van Es, 2009).

Informing teachers' understanding of their own practices using video clips within video clubs is also mentioned to underline the relevance on belonging to professional communities of teachers learning and professional development.

We underline the perspective of community teachers video clubs because of the collaboration potentials and benefits of these tools and platforms, as "video clubs enable teachers to analyze their teaching practice in a collaborative group, providing them with opportunities to develop their understanding of concepts and professional vision (Van Es, 2009).

The most significant benefits are heightened motivation, optimized cognition, and improved classroom practices (Gaudin & Chaliès, 2015).

Video clubs has also been used to bring teachers together to analyze student thinking and learners' behaviors (Van Es & Sherin, 2010).

We also include in this model the sharing of video recordings of teacher's practices in online professional communities between groups of teachers. Within these communities' teachers are invited to recording their own teaching practices and uploading videos to an online video database in the field of Teacher Education. These videos can be used within an online professional community for sharing, self-observation, collaboration and reflection (Lebak & Tinsley, 2010).

Model for support collaborative learning through the use of video traces

Video traces are carefully selected sample video from trainee's classroom practice to view, discuss and analyze collaboratively with their peers, veteran teachers and university teachers (Bier *et al*, 2012); in this model, teacher trainees made videos as examples of their class-room practice and student work. Video traces were viewed and collaboratively analyzed, and feedback given by cooperating teachers, field supervisors, university teachers. Collaborative discussion offered some gains and benefits for all partners i.e. novice teachers, veteran teachers and university teachers.

Model for support collaborative learning through the use of teaching video cases

Video cases are video recordings showing authentic and complex realities of classrooms in ill-structured domains of teacher education and initial teacher education (Goeze, Zottmann, Vogel, Fischer & Schrader, 2014).

Video cases has been used to promote teachers' discussions of video cases – the study of published materials and of experienced teachers in their professional practices – in order to have enhance professional practices quality.

Video cases have been also used in initial teacher training contexts. It involves groups of learners working together (collaboration) and situated learning in a meaningful authentic context in which learners can explore the content by engaging in thinking and problem solving. Students emphasized the connection that digital video cases made between theory and practice, helped create teacher identity, and fostered recognition of students and their characteristics (empathy) (Koc, 2011).

Model for support collaborative learning through teachers' video clips

In this model, short videos (video clips) - are used inside the Dialogic Video Cycle. Videos recordings from reflections of teacher's own teaching practices serve as anchors for collaborative discussions, providing positive and valuable individual conditions for teacher changes of classroom practices (...) Inspired in the PSC approach by Borko, Jacobs, Eiteljorg, & Pittman (2008) - Problem-Solving Cycle - the approach of Dialogic Video Cycle - consists of ongoing cycles of three interconnected PD workshops. It has the same number and duration of workshops, and the workshops are monitored by a facilitator who moderates them and organizes the videotaping of the teachers' lessons and the selection of video clips (Gro ̈schner, A., Seidel, T., Kiemer, K. & Pehmer, 2015).

Model for supporting collaborative learning embedded in professional development

This is a model centered in peer review of previously recordings of teachers own practices as a professional development source.

Video recordings of teachers' own practices and peer review as a model for PD, was found in some established and comprehensive professional development initiatives as the Problem Solving Cycle (which is an iterative, long-term PD approach developed in mathematics education) that focuses on specialized content knowledge and pedagogical content knowledge.

Video peer review can also be found in Interconnected Professional Growth (IPG) a professional development initiative that motivates teachers to use video-supported collaborative reflections based on the video recordings of teachers' own teaching practices, designed to enhance teachers' use of inquiry-based science in their classrooms. Through the process, teachers video recorded their lessons and reflected individually on the lesson. Next, the teachers collaboratively viewed and reflected upon the videotaped lesson with a peer group. The peer groups were

comprised of 4–6 other teachers that worked together for a full academic year (Lebak, 2015).

Video Stimulated Recall model (VSR)

Video stimulated recall model (video recording prospective teachers' practices) was used to improve prospective teacher's performance in specific professional competences in a cycle of video-recording, collaborative discussion and practices improvement. VSR is a collaborative supervision model which involves a supervisor and prospective teachers collegially re-viewing a previous video recording lesson or practices - a videotape [video recording] of a lesson - or particular sections of the lesson, while identifying specific occurrences for discussion (Kelting, Jenkins & Gaudreault, 2014).

A similar model was found in health training systems where video recording of simulation training was used to reflect and give feedback to the trainees, during post-simulation de-briefings. "During the debriefings, short video-recorded sequences of the students' collabo-ration in the scenarios were shown, after which the facilitators asked the students questions about the teamwork and their performance as displayed in these sequences. (…) In this way, the video enabled the students to talk about their own conduct, including their collaboration with their peers, from a third-person perspective. The study highlights the central role of instructions and instructional questions in the debriefings, how the video was used to make the students reconceptualise their performance together with others, and the importance of contributions from fellow students" (Johansson, Lindwall & Rystedt, 2017).

Model for supporting collaborative learning through action-research

Within action-research teachers involvement model, teachers use video recordings of their teaching practices and engage in a weekly peer group collaborative reflection session, collaborate with students, and consult with other sources to identify goals for improving their teaching practices, develop action plans, and analyse the results of their actions. The action research model provides opportunities for self and collaborative critical reflection that challenged each of the teacher's traditional methods. Collaboration with peers and students was crucial at each stage of the action-research process for these science teachers (Lebak, K., & Tinsley, 2010). "We found that an unedited video of teaching constitutes the most complete conveyance of a teacher's classroom performance available and provides opportunities for a teacher and others to view and reflect upon the whole picture of practice, including instructional techniques, levels of student engagement, and student achievement of learning objectives. Video, therefore, serves as an object of

reflection, a touchstone for insight, and a reference point for witnessing development "(Lebak, K., & Tinsley, 2010).

Video data collection as a model for supporting collaborative learning

Groups of teachers, researchers, students and parents learn with each other and collaborate using video recording technology. Multimodal video analysis, classroom observations, inter-views and informal conversations with teachers, children and parents are used for data col-lection source but also as a source for analyzing teachers own pedagogical practice in the classroom (Davidsen, J., & Vanderlinde, 2014).

Model for supporting collaborative learning through video creation

This model was best used as a fundamental resource embedded within students centered pedagogical perspectives – project-based learning, inquiry-based learning, e.g., where students became producers and collaborators (De Berg, 2016).

This model also considers authors and developers in online communities of e-practioners based on virtual learning environments (Larsen, Sanders, Astray & Hole, 2008).

Literature also suggested "digital video technologies offer a variety of functions for supporting collaborative learning in classrooms. Yet, for novice learners, such as school students, positive learning outcomes also depend centrally on effective social interactions. Authors highlight the importance of student's guidance in terms of social interaction for effective learning outcomes (Zahn, Krauskopf, Hesse & Pea, 2012).

The model involves different types of learning experiences as "both learning and teaching are considered active processes of constructing and reconstructing knowledge, skills, values and attitudes from previous and new experiences that participants share in the learning environment". Students centered pedagogical approaches as problem-based or task-oriented learning, cooperation, interaction and dialogue among students and teachers, self-reflection on learning as a tool for professional development, transparency and evidence-based writing are some the learning activities reported within this model.

Another example in creating video comes from higher education context. Students from a technology university were asked "to create their own pattern-making video tutorials in an effort to deepen authentic learning. (...). Ultimately active knowledge production deepened learners' motivation, engagement in the learning process, and increased performance (Cavanagh & Peté, 2017).

Model for supported collaborative learning through content video displaying

This model refers to the more traditional types of video for educational uses: instructional and lectures video, explanation or demonstration video, simulation video, documentary -style video, user generated video content, video with teacher talks and tutorial video, e.g.

Content video displaying can be used for presenting content in a more concise and visual and multimedia format, also can be used for motivating students and learners to foster topic understanding and promote learning.

The uses of content video displaying types - in some studies designated as video for instructional purposes - are very broad and was used for very different target-groups and also imbedded in different pedagogical approaches as traditional face-to-face lessons, online les-sons (MOOCs, p.e.) or in a more active learning approach, including collaborative learning, depending on teachers or facilitators perspectives.

Literature shows that to be more effective, content video displaying can be supported by teachers who can facilitate a more structured guidance, as posing reflective questions to the students, before and after viewing, providing materials to supplement the video as well as support group discussion around the content of video (Duff, Sauer & Gleason, 2011).

The model for supported collaborative learning through content video displaying can be implemented for students as well as for teachers and pre-service teachers for self-regulated learning, self-reflection tool and producing digital narratives. For teacher education and initial teacher education content video displaying can be used to promote observation skills, analyzing and sharing practices and reflections of teachers' videos of their own teaching using individual case analysis, case based learning and collaborative case discussions (Zottmann *et al*, 2013).

Model for supporting collaborative learning through interactive and hypervideo

Within this pedagogical model, video is used to support collaborative learning and knowledge building through different types of activities using computer systems networks technical affordances allowing a non-linear and interactive uses of the video content for navigation, an-notation tools (using bookmarks, links, anchors, taking notes and comments), sharing and authoring tools to promote social and learning interaction possibilities.

Integrating video in digital hypertexts environments can enriches learning cognition, as video can be used for 'replacing' real experience, visualizing dynamic processes, and combining diverse symbol systems (Chambel, Zahn & Finke, 2006).

Research literature in this area consistently emphasizes the potentials of design projects as a promising instructional method to serve several important educational goals at once: the goal of training skills, the goal of building dynamic social relations and of building knowledge (...) Learning to observe and learning to analyze as well as learning to integrate text and video - learning to design non-linear information structures (Zahn *et al*, 2005) are special dimensions of this pedagogical model for supporting collaborative learning.

Video annotations by beginning teachers in the form of written documents can be used to identify goals for improvement and videos to evidence of their progress. Using video annotation was related to professional development goals (McFadden, 2014).

More recently, research suggested that hypervideo can be used within two complementary theoretical approaches: (1) the cognitive approach with its focus on information processing, and (2) the socio-cultural approach which highlights social interaction and context (Cattaneo, Van der Meij, Aprea, Sauli & Zahn, 2018).

Further investigation on hypervideo and particularly on iVideo. Education shows that the hypervideo model "includes two intertwined dimensions that the teacher must consider: the (hyper)video-related design phase and processes and the involvement of the different ac-tor(s) therein. The first-dimension deals with the phases and tasks involved in the design of hypervideo-based learning scenarios. More specifically, this dimension includes the following: 1) A preparation phase, comprising both the identification of the reference raw video and its editing; 2) a production phase, devoted to making the video interactive, thus producing a hypervideo; and 3) a use phase, in which the hypervideo is employed as learning material. The second dimension refers to the instructional strategies that a teacher may want to employ (Cattaneo, Van der Meij, Aprea, Sauli & Zahn, 2018, p.10).

Model for supporting collaborative learning using video as a communication tool

This is a model for supporting collaborative learning using video as a communication tool in professional contexts. There is evidence that video technology used either synchronously or asynchronously, can extend the quantity and quality of classroom observation experience, which in turn supports the development of observation, analysis and reflection in viewers" (...) Within this video usage model, technology is used by in-service teachers, pre-service teachers, tutors, supervisors and students to linking teacher professional contexts – classroom practices - to teacher learning contexts using live video to promote reflection, collaborative discussions and the acquisition of a pedagogical language by trainee teachers (Marsh & Mitchell, 2014).

Other learning experiences includes using live video for improving teacher's pedagogical competencies in communication or conducting learning processes, mentoring and feedback on their teaching practices. This pedagogical model of

using live video were also reported as live lessons and remote classroom observation, web-based conferences, video conference assisted group, video-based conference lectures for teaching and learning purposes using live video technology. These video modalities can include multi-person video conversations, lives-streaming /broadcasting real-time, live video footage or video feed to an audience accessing the video stream over the internet. It can be just video, audio or both. Social interactions can happen through voice or webcam, videotext chat and twitter feed. In educational contexts live video can be used for broadcasting live seminars, workshops, live-labs, webinars, short courses, group research activities and others.

Model for support collaborative learning through video-problem solving.

A short video is created using a story or a narrative to challenge students to get a solution for the problem. Video can also include contextual information, as information sources and data, in order students can get a better comprehension of the problem. The video-problem is an opportunity for learners to apply their shared knowledge to a relevant problem and the video supports ongoing problem comprehension (Hmelo-Silver, 2004).

In this model, video-problem can be embedded in project-based work, anchored instruction or problem-based learning. Creating and using a video can trigger for intrinsic motivation, collaborative learning and an opportunity for student to develop problem solving and collaborative skills. The author gives an example of a course of preservice teachers using video problems and a web-based information resource where students viewed a video that showed a student being interviewed before and after instruction along with some excerpts from the instruction. (Hmelo-Silver, 2004).

Their task was to explain why the student featured in the video failed to learn. According to Bereiter and Scardamalia (1989), students become responsible for their own learning, which necessitates reflective, critical thinking about what is being learned (Hmelo-Silver, 2004).

Limitations

This literature review has some limitations that we want to recognize. First of all, the emergent and innovative nature of the fundamental concept of this literature review: the concept of video-supported collaborative learning.

In fact, the research made evident the lack of studies and investigations on this specific topic with regard to video-supported collaborative learning. Studies that referred to this concept in its integral form were very rare.

A large majority of the studies refer either to the use of video on professional development of teachers, trainers and other professionals or to collaborative learning within the framework of teacher training, with a smaller number of studies that cross and combine these areas.

Although a significant number of studies report the use of video in educational and collaborative learning processes, they do not refer specifically to video-supported collaborative learning. It is therefore a concept that comes to integrate and typify a set of professional and pedagogical practices that have in common a certain purpose and a pedagogical perspective in the use of video that of to be used for support collaborative learning processes.

A second limitation concerns to the consulted scientific databases which, although in significant numbers, are far from exhausting all the possibilities of scientific publication. In saying so, we cannot guarantee that there are no published studies in other databases that were not considered in the initial criteria.

Finally, the content of this literature review is not only a systematic review but other studies were included as it were considered relevant to complete and deep the review.

Conclusions

This review of the literature revealed the existence of four modalities of video usages that were adopted to support collaborative learning in different contexts such as teacher education, initial/prospective teacher education, teacher's professional development, vocational/ professional training, and educational processes related to primary and secondary education.

In the framework of professional development of teacher's programmes and initiatives thirteen models of video-supported collaborative learning were found and described in detail throughout the review.

The vast majority of the models were adopted for facilitation of teachers' professional development through the use of video recordings of professional practices that involve collaborative learning and knowledge building perspectives.

Literature review reports the use of the same models in different contexts, as p.e. video content display, video creation, video as communication tool or video interactive and hyper-video. That means that there are many possibilities of exploring video supported collaborative learning models in the educational contexts and its specific professional development practices or teaching and learning processes.

The findings of this literature review are therefore the knowledge base to inform the pedagogical practices that will be implemented in the context of the experimentations of the VIS-UAL project, regarding the use of video-supported collaborative learning and can be re-searched again in the light of the main concept of the study.

Some of the models will be deeply investigated through experimentations (the model of video clubs, the model of interactive/hypervideos and the video-problem model, for example), while new models of video supported collaborative learning can be inspired and experienced to investigate their pedagogical potentials to support teacher's professional development, vocational and professional education and basic and secondary education.

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