AMMIL: A METHODOLOGY FOR DEVELOPING VIDEO-BASED LEARNING COURSES

J. Quemada[1], E. Barra[1], A. Gordillo[1], S. Pavon[1], J. Salvachua[1], I. Vazquez[2], S. López-Pernas[1]

[1]Universidad Politécnica de Madrid (SPAIN)
[2]Escuela Superior de Diseño (SPAIN)

Abstract

Videos are extensively used nowadays to support learners in a variety of educational settings such as traditional online courses, MOOCs (Massive Open Online Courses), flipped classrooms, and blended courses. Therefore, it is of prime importance to develop methodologies capable of producing effective video-based learning courses which can lead to the highest success and learner satisfaction. AMMIL (Active Meaningful Micro-Inductive Learning) is a methodology for creating video-based learning courses, which aims to maximise the instructional effectiveness in terms of motivation and academic performance in self-learning environments. This methodology has been successfully used to create several MOOCs, as well as to support a blended programming course at a higher education institution. This paper presents the AMMIL methodology and an evaluation of two different MOOCs and a higher education programming course in which this methodology was applied. This evaluation was conducted by using student surveys as data collection instruments. The results are very promising since they show that students were very satisfied with the courses created applying the AMMIL methodology.

Keywords: MOOC, flipped classroom, self-learning, project-based learning, active learning, video in education, meaningful learning, inductive learning, microlearning.

1 INTRODUCTION

Nowadays, videos are widely used in order to support learners in a variety of educational settings including traditional online courses, MOOCs (Massive Open Online Courses), flipped classrooms and blended courses [1], [2]. Although the development of a video-based learning course may seem easy a priori, it is actually a very resource-consuming task. The Chapman Alliance [3] differentiates three levels of e-learning according to the complexity of the content type: basic, interactive and advanced. According to this classification, courses consisting of presentations and exercises would be “basic”; those with multimedia (such as videos) and interactive exercises would be “interactive”, and, finally, those including games and simulations would belong to the “advanced” category. The aforementioned study concluded that the average ratio between the number of hours devoted to the development of the course and the number of hours of learning material generated is 79 for basic courses, 184 for interactive courses, and 490 for advanced ones.

One of the reasons for video-based courses to be so resource-consuming is that presentation styles that have worked well in traditional in-person lectures do not necessarily make for effective online educational videos. Guo, Kim and Rubin [4] analysed how video production affects student engagement, examining 6.9 million video-watching sessions across 4 courses and found that in order to maximise student engagement, instructors must plan their lessons specifically for an online video format. This means that not many resources created for face-to-face learning can be reused in video-based courses. These findings are in agreement with those of [5], in which the authors state that the most successful instructors are those who spend the most time preparing for their video shoots. However, it is often very difficult to get instructors to understand the importance of pre-production.

The lifecycle of an e-learning course or a video-based course does not differ greatly from that of a traditional course. It encompasses three different main phases: creation (including analysis, design and development), deployment, and assessment. In the literature we can find e-learning methodologies [6], [7] that present an overall picture of the whole lifecycle of an e-learning course.

Despite the fact that the lifecycle of a video-based course is analogous to that of a traditional course, when creating one of the former, most aspects should be reconsidered: from the instructional design to the authoring of the different materials or the video production. Moreover, the structure and content of the materials of the course, as well as the interrelations among them, have a strong impact on its

instructional effectiveness. It is, therefore, of prime importance to develop methodologies capable of producing effective video-based learning courses which can lead to the highest success and learner satisfaction.

The most popular video courses nowadays are MOOCs. In general terms, MOOCs can be divided into two categories depending on how the learning takes place: cMOOCs (connectivist MOOCs) and xMOOCs (eXtended MOOCs) [8]. In cMOOCs, learning occurs socially through the network of participants as they are based on the connectivism theory. In xMOOCs, learning takes place mainly by means of the provided contents as they are based on behaviourism, cognitivism and constructivism theories. Due to their popularity, many studies propose methodologies to design MOOCs [9]–[11], paying special attention to cMOOCs [12], [13] as their instructional design and learning process is quite innovative.

This article presents the AMMIL (Active Meaningful Micro-Inductive Learning) methodology for creating video-based learning courses and their associated learning objects, whose main objective is to maximise the instructional effectiveness in terms of motivation and academic performance in self-learning environments. The rest of the paper is organised as follows. Next section describes the AMMIL methodology in detail. Section 3 presents the results of the application of this methodology on the creation of two different MOOCs and a higher education programming course. Finally, the last section provides the main conclusions of this work and some directions for future work.

2 AMMIL METHODOLOGY

2.1 Context

AMMIL (Active Meaningful Micro-Inductive Learning) has been developed on the basis of the feedback received from several courses performed in two different learning contexts: (1) four MOOCs offered in Spanish through the MiriadaX platform [14], and (2) an on-campus course of the Bachelor's Degree in Telecommunications Engineering from UPM (Universidad Politécnica de Madrid).

The four MOOCs used to shape the AMMIL methodology are xMOOCs and have been very successful, with several editions offered for each of them and nearly 300.000 enrolments altogether. These MOOCs are entitled as follows:

- Software Project Management with Git and GitHub
- Frontend development with HTML, CSS and JavaScript
- Backend development with Node.js, Express and Databases
- Development of a Fullstack Project with JavaScript

The on-campus course is entitled "Internet Computing" and it is a third-year mandatory subject of the Bachelor's Degree in Telecommunications Engineering from UPM, with more than 300 enrolled students per year. The topics covered in this course are very similar to those presented in the four MOOCs, with the exception that in the MOOCs the syllabus is significantly extended with more introductory topics for newcomers and some advanced topics making them self-contained and appealing.

2.2 Design principles

AMMIL is a methodology aimed at helping in the design and development of video-based learning courses. The rules and guidance to generate course materials provided by AMMIL try to maximise the motivation of learners and to minimise the effort needed to achieve a given set of Learning Objectives (hereafter LOs). AMMIL is the acronym of "Active Meaningful Micro-Inductive Learning" in recognition of the main learning theories on which it is based, namely active learning [15], meaningful learning [16], [17], microlearning [18], [19], and inductive learning [20].

2.2.1 Active learning

Active learning [15] is a form of engaging students in the learning process, encouraging them to take an active role in their training and, at the same time, reflect on the knowledge they acquire.

Since watching videos can be an extremely passive activity, AMMIL proposes to intertwine video-watching sessions with active-learning activities such as exercises or evaluations, which help

students consolidate the achievement of the LOs in a motivating way. Using evaluations as motivating learning activities should be done not only at the module evaluation level, with deeply creative and thorough exercises, but also at the activity evaluation level, with exhaustive tests or simple exercises aimed at consolidating the understanding of the topic explained.

In courses aimed at teaching practical skills, AMMIL also embraces Project-Based Learning (PBL) so as to foster student engagement [21]. When following a PBL approach, each module is conceived as a step towards the completion of a project. Students engage in the creation of one or several projects during the course, which are graded by means of peer-to-peer (P2P) evaluations. Creating and evaluating are the two highest skills in Bloom's Taxonomy [22], [23], meaning that they entail the greatest complexity and level of understanding.

2.2.2 Meaningful learning

Meaningful learning [16], [17] advocates that learned information must be linked or mapped to previously acquired knowledge so as to aid in further understanding and to reduce the cognitive effort needed.

AMMIL, based on meaningful learning theory, states that the order of the learning activities must be properly established so that no piece of knowledge is applied prior to being previously explained. Furthermore, a very powerful second consideration or rule of meaningful learning included in AMMIL is that module evaluations must have what is known as a meaningful design. A meaningful design implies that exercise statements of proposed works, problems to be solved or designs to be implemented must include part of the solution. The partial solution provided can be used by students as a model for finalising the assignment, as well as a means of further consolidating the module LO, or even covering parts of the LO which have not been sufficiently explained in the previous parts of the module. The preparation of such meaningful exercises is resource-consuming and leads to lengthy work statements but pays off in terms of learning effectiveness.

Finally, AMMIL specifies that activity assessments should be formative to improve student attainment [24]. They should provide as much feedback as possible to improve students' awareness of their own learning and let them know if they have properly understood the content provided in the activities proposed [25]. AMMIL also recommends using exhaustive tests combined with small exercises whose resolution requires students to understand everything explained in the previous activity.

2.2.3 Microlearning

Microlearning [18], [19] is an approach to learning based on short, concise lessons delivered to learners in an immediate way when they decide to devote some time, no matter how brief, to learning. Since the human attention span is short and can hold up only a couple of new pieces of information at a time, microlearning tries to minimise both the time needed to perform a given learning activity and the number of new information pieces to be learned, so as to match our cognitive abilities.

AMMIL proposes to divide the course LO into smaller LOs, each of which must be addressed in a course module. Then, each module LO should be divided into smaller LOs, called Micro Learning Objectives (uLO), that will be the LOs of the activities. A properly chosen uLO should meet the following three requirements:

1 It must be possible to explain it in a short video (6 to 10 minutes recommended).

2 It must allow a proper evaluation (a test or short exercise) covering everything explained.

3 It must include at least one example of minimum complexity.

There are studies that recommend using short videos [4], but there are other ones in which longer videos have worked well, especially as support material of on-campus courses [26].

2.2.4 Inductive learning

Inductive learning [20] also known as discovery learning or learning by example, is a process in which the learner discovers rules by observing examples. The learning activities of the course should first deal with the most relevant use cases and examples of the knowledge or skill to be learned. The learning activities dealing with general theories, rules and laws should always take place after the most important particular examples and use cases have been dealt with.

AMMIL recommends illustrating every step with proper examples, which it termed micro-examples or uExamples. A uExample is an example of minimum complexity which illustrates the knowledge to be

acquired and nothing else. A uExample helps students to understand a given uLO and only that uLO. Development of such minimum complexity examples is resource-consuming but worth it in terms of learning effectiveness.

2.3 Methodology in detail

The AMMIL methodology provides a precise guide on how to create video-based courses for self-learning and their associated learning objects. The guidelines provided by this methodology try to minimise students' effort to achieve a given set of LOs in a video-based self-learning course, in which students are engaged in a meaningful and inductive learning process based on microlearning resources. The AMMIL methodology proposes a top-down process that can be summarised as follows:

1 Define the course LO.

2 Divide the course LO into smaller LOs in such a way that each of them can be addressed in one module. Thereby, the course is divided into modules based on these LOs.

3 Define the module evaluations and, if the course is PBL-oriented, the projects.

4 Divide each module into activities.

5 Define proper examples for each activity.

6 Create slideshows, documents and activity evaluations assuring coherence among them.

7 Check that:

   a. Everything which is explained is evaluated.

   b. Everything which is evaluated has been explained before.

8 Start recording only when the complete structure of the course is sound and a sufficiently mature version of all the materials (documents, slides and evaluations) has been generated.

AMMIL is a LO-oriented design methodology. Our experience indicates that the design should start with a top-down process which makes the overall structure explicit and identifies the sequence of modules of which the course is composed. Therefore, the first step is to define the course LO and break it down into smaller LOs. From each LO a module should be created, in such a way that the union of all of them covers the LO of the complete course, as shown in Fig. 1.

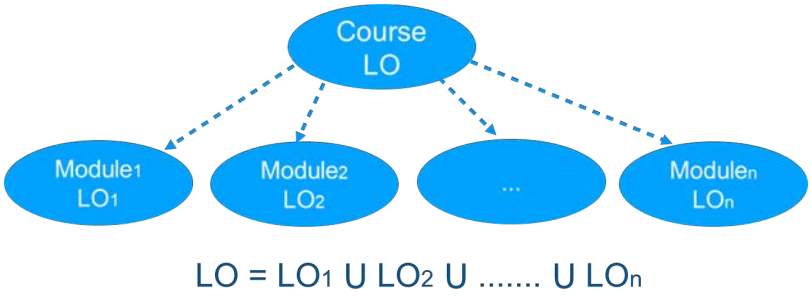

Figure 1. Learning Objectives (LOs) of a course and its modules.

After the module LOs have been identified, the module evaluation exercises should be produced or at least thoroughly outlined. One of the basic ideas behind AMMIL is that evaluations are learning activities in which the knowledge acquired previously must be actively exercised and consolidated. Module evaluations can be very motivating if properly designed. The previously defined meaningful evaluations have shown high effectiveness. In this approach, the statement of the module evaluation should include part of the solution, such that the solved part can be used as a model for finalising the exercise.

The exercise statement may include also an additional LO, which should be properly explained there. Video screencasts can be used, in addition to the written statements, to further illustrate the solved part of the meaningful exercise.

In the case of MOOCs, a popular way of performing module evaluations are Peer to Peer (P2P) exercises, because the number of participants makes it impossible for the instructor to correct the exercises one by one and provide customised feedback.

When the module LO and the module evaluations have been specified, the LOs of the individual learning activities of the modules should be defined to cover the module LO. AMMIL refers to the LOs of the module activities as micro-LOs or uLOs, as they belong to a lower level of granularity. As shown in Fig. 2, the union of all the uLOs of a module must cover the module LO and the module evaluation should cover and consolidate the union of all the uLOs.

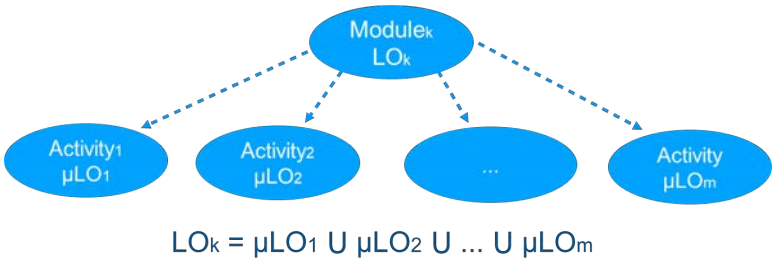

Figure 2. Learning Objectives (LOs) of a module and its activities.

Typically, a video-based learning activity is composed of up to four types of elements, as shown in Fig. 3. The documents to be downloaded, a video lecture, and activity evaluations in the form of tests and/or exercises. Gamified activities, simulations and other types of sophisticated learning resources can be included but AMMIL focuses only on those four.

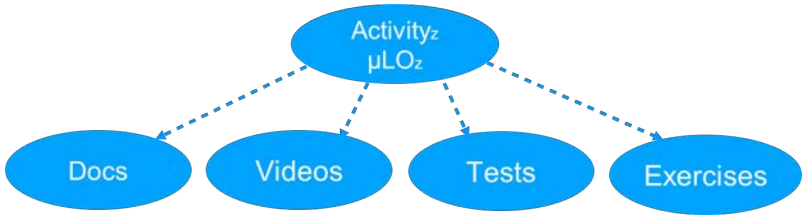

Figure 3. Activity composition

Most of the learning activities use video recording based on small slideshows, which include pointers to relevant complementary resources and use one or several examples of minimum complexity which illustrate the knowledge to be acquired (and only that). These examples, termed uExamples by the AMMIL methodology, help to clarify the uLO of the activity.

The production of the slides and video lectures should also be guided by uLOs. Considering a new lower level of granularity, the activity uLO can be divided into nano Learning Objectives (nLOs), that can help to create the activity parts, for example, the slides of the slideshow. Each activity part (e.g. each slide) should have a clear nLO. Nano LOs are also useful to design exhaustive evaluations, in the form of tests or exercises, which serve as learning activities consolidating the explanations of the activity as illustrated in Fig. 4. In the case of using scripts for video recording, nLOs can also play the same role. The evaluation of an activity (in the form of tests and/or exercises) should cover the complete set of nLOs of that activity.

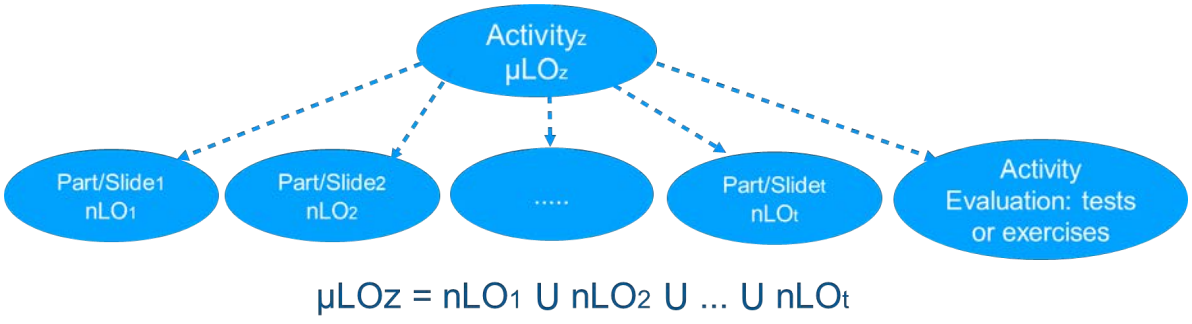

Figure 4. Nano Learning Objectives (nLOs) of an activity.

During the definition and production of all the resources of the course, inconsistencies and potential improvements may become explicit. Bottom-up revisions and modifications of the structure can be made to resolve those inconsistencies and improve the course.

3 EVALUATION AND RESULTS

In order to assess the suitability of the AMMIL methodology to create video-based learning courses, an evaluation has been conducted addressing two MOOCs conducted on the MiriadaX platform and an on-campus course of the Bachelor's Degree in Telecommunications Engineering from UPM. This evaluation was conducted by using student surveys as data collection instruments: one survey was conducted at the end of the two MOOCs, and another one at the end of the on-campus course. The surveys were different in each of the scenarios because the use of videos in each of them was also very different, but these surveys also had some common questions.

3.1 MOOCs

We have gathered the opinions of students that participated in the MOOCs entitled "Software Project Management with Git and GitHub" (consisting of 12 videos, 10 tests, 4 P2P exercises, and a forum) and "Backend development with Node.js, Express and Databases" (consisting of 59 videos, 32 tests, 9 P2P exercises and a forum), in their 2019 edition, by means of a survey. The survey was answered by 450 students, 88.2% (397) males and 11.8% (53) females, between 15 and 69 years of age (M=41.1, SD=11.0). For 21.5% (97) of them it was the first time that they had participated in a MOOC, whereas 78.5% (353) had already participated in one before. Students considered their previous knowledge of the course content in a scale of 1 (horrible) to 5 (excellent) to be somewhat low (M=2.8, SD=1.2).

Overall, 89.8% (404) participants studied the modules following the order outlined by the teachers. However, 10.2% (46) of them studied only the modules that were of their interest. We interpret this result as very positive, because the order of the learning activities along the course had been properly established following the AMMIL methodology so that no piece of knowledge is applied prior to being explained.

There was a question about the number of videos the participants watched. A total of 47.8% (215) of the participants answered that they watched all the videos, 6.7% (30) between 80% and 99% of the videos, 10.7% (48) between 50% and 80%, 19.3% (87) between 10% and 50%, and finally 15.5% (70) less than 10% of the videos.

We also asked students to rate the usefulness of the different content and functionalities of the MOOCs. The results of this part of the survey are shown in Table 1. These results are consistent with previous research [4], [27], and confirm that videos were considered the most useful resource (M=4.3, SD=1.0), followed by the slides used to record them (M=4.2, SD=1.0). The least useful resources were considered to be the online forums (M=3.6, SD=1.2).

Table 1. Results of the student survey on the usefulness of content and functionalities in the MOOCs

	N	***M***	***SD***
Please, state the level of usefulness of the following content and functionalities of the course:(1 Not useful at all - 5 Very useful)			
Videos	430	4.3	1.0
Slides used to record videos	427	4.2	1.0
Simple examples used in slides and videos to illustrate what has been explained	431	4.2	1.0
Tests	425	4.0	1.2
Optional P2P exercises	400	4.0	1.2
Compulsory P2P exercises at the end of each module	410	4.1	1.1
Help from fellow students (forums)	389	3.6	1.2

There were two questions in the survey that were aimed at finding out if students would recommend the course to a friend or colleague, to which 90.4% (407) answered affirmatively, and if they would take a similar course covering different topics, to which 95.1% (428) answered affirmatively. Finally, they had to state their general opinion of the courses in a scale of 1 (horrible) to 5 (excellent), and the result was that they had a very good opinion of the courses (M=4.2, SD=0.9).

Overall, the results of the student surveys suggest that the MOOCs created following the AMMIL methodology were useful, that students liked it, and that students would take more courses created following this methodology.

3.2 On-campus course

We have also gathered the opinions of the students enrolled in the on-campus third-year "Internet Computing" course of the Bachelor's Degree in Telecommunications Engineering from UPM. A total of 183 students answered the survey, of which 75.4% (138) were males and 24.6% (45) were females, 20 to 30 years of age (M=21.7, SD=2.0). Table 2 shows the results of this survey.

In the on-campus course, the usefulness of the videos was considered very high (M=4.1, SD=1.0) but in this case the resources related to the assignments were rated higher: the video screencasts in which students could see the teacher programming (M=4.6, SD=0.8), the assignments themselves (M=4.3, SD=1.0), and the face-to-face lessons where the teacher provided help solving them (M=4.4, SD=0.8). The results of the survey also show that the students thought that the videos were a good complement to the course (M=4.3, SD=0.9) and they would like to use this kind of videos in other courses as well (M=4.5, SD=1.0).

Overall, the results of the student survey suggest that students had positive attitudes towards the on-campus course in which the AMMIL methodology was applied, and that this course was useful.

Table 2. Results of the student survey in the on-campus course

	N	***M***	***SD***
Please, state the level of usefulness of the following content and functionalities of the course: (1 Not useful at all - 5 Very useful)			
Face-to-face lectures	131	3.0	1.2
Slides	181	3.0	1.3
Videos of the course content offered on the Moodle platform	181	4.1	1.0
Assignments/exercises of the course	183	4.3	1.0
Video screencasts that support assignments/exercises	180	4.6	0.8
Lessons to assist in the resolution of the assignments/exercises	80	4.4	0.8
Examples	172	3.7	1.1
Forums	178	3.3	1.3
Please, state your level of agreement with the following statements: (1 Strongly disagree - 5 Strongly agree)			
The structure of the course in short topics is adequate	178	3.8	1.0
The videos are a good complement for this course	179	4.3	0.9
Course content videos can replace face-to-face lectures	170	3.7	1.4
I prefer to see the videos of the course rather than going to class	176	3.8	1.4
I would like to have videos like the ones used in "Internet Computing" in other courses	178	4.5	1.0
I prefer to carry out large projects in several phases rather than small projects	173	3.5	1.4
What is your general opinion of the course?	183	3.7	0.9

4 CONCLUSIONS

This paper presents the AMMIL methodology for developing video-based learning courses. This methodology goes beyond instructional design by providing precise guidance on how to create video-based courses for self-learning and the associated learning objects. The guidelines provided by the methodology try to minimise students' effort to achieve a given set of learning objects in a video-based self-learning course, in which students are engaged in a meaningful and inductive learning process based on microlearning resources. AMMIL also provides recommendations to help instructors in such a resource-consuming task as is creating a video-based course.

The AMMIL methodology was used to create two different MOOCs and a third-year on-campus course of the Bachelor's Degree in Telecommunications Engineering from UPM. We have gathered the opinions of students in both scenarios with a survey at the end of each course. Students' opinions show very promising results in both educational settings. In this regard, it is worth highlighting that students considered the videos to be one of the most useful resources of the courses.

Our future plans include validating this methodology in other video-based learning courses such as SPOCs (Small Private Online Courses) and cMOOCs. It would also be very interesting to measure the learning effectiveness in terms of learning outcomes of courses created with AMMIL by using a pre-test/post-test design, as well as to compare this type of courses with other ones created following different methodologies.

REFERENCES

[1] M. N. Giannakos, 'Exploring the video-based learning research: A review of the literature', *British Journal of Educational Technology*, vol. 44, no. 6, pp. 191–195, 2013.

[2] R. H. Kay, 'Exploring the use of video podcasts in education: A comprehensive review of the literature', *Computers in Human Behavior*, vol. 28, no. 3, pp. 820–831, 2012.

[3] B. Chapman, 'How long does it take to create learning', *Chapman Alliance*, 2010.

[4] P. J. Guo, J. Kim, and R. Rubin, 'How video production affects student engagement', in *Proceedings of the 1st ACM Conference on Learning@scale*, 2014, pp. 41–50.

[5] A. Hansch, L. Hillers, K. McConachie, C. Newman, T. Schildhauer, and P. Schmidt, 'Video and Online Learning: Critical Reflections and Findings from the Field', *SSRN Electronic Journal*, pp. 77–101, 2015.

[6] F. J. García Peñalvo, *Advances in e-learning : Experiences and Methodologies*. Information Science Reference, 2008.

[7] B. Ghirardini, *E-learning methodologies : a guide for designing and developing e-learning courses*. Food and Agriculture Organization of the United Nations, 2011.

[8] A. McAuley, B. Stewart, G. Siemens, and D. Cormier, *The MOOC model for digital practice*. University of Prince Edward Island, 2010.

[9] L. Guàrdia, M. Maina, and A. Sangrà, 'MOOC design principles: A pedagogical approach from the learner's perspective', *Elearning Papers*, vol. 33, pp. 1–6, 2013.

[10] M. Gértrudix Barrio, M. Rajas Fernández, and S. Álvarez García, 'Metodología de producción para el desarrollo de contenidos audiovisuales y multimedia para MOOC', *RIED. Revista Iberoamericana de Educación a Distancia*, vol. 20, no. 1, p. 183, 2017.

[11] C. A. Hoyos, M. P. Sanagustín, and D. Cormier, 'Proposal for a conceptual framework for educators to describe and design MOOCs', vol. 20, no. 1, pp. 6–23, 2014.

[12] Á. F. Blanco, F. J. García-Peñalvo, and M. Sein-Echaluce, 'A methodology proposal for developing adaptive cMOOC', in *Proceedings of the 1st International Conference on Technological Ecosystem for Enhancing Multiculturality - TEEM '13*, 2013, pp. 553–558.

[13] F. Brouns, J. Mota, L. Morgado, D. Jansen, and S. Fano, 'A networked learning framework for effective MOOC design: the ECO project approach', in *Challenges for Research into Open & Distance Learning*, 2014, pp. 161–171.

[14] 'MiriadaX'. [Online]. Available: http://miriadax.com. [Accessed: 26-Sep-2019].

[15] S. Tong, *Active learning: theory and applications*. USA: Stanford University, 2001.

[16] D. P. D. Ausubel, *The psychology of meaningful verbal learning;* Grune & Stratton, 1963.

[17] D. P. Ausubel, *Adquisición y retención del conocimiento: una perspectiva cognitiva*. Editorial Paidós, 2002.

[18] T. Hug, 'Micro Learning and narration', in *4th Media in Transition Conference*, 2005, pp. 6–8.

[19] J. M. Anil and O. H. Slade, 'Micro learning as innovative process of knowledge strategy', *International Journal of Scientific & Technology Research*, vol. 11, pp. 92–96, 2012.

[20] R. S. Michalski, 'A Theory and Methodology of Inductive Learning', in *Machine Learning*, Heidelberg: Springer Berlin Heidelberg, 1983, pp. 83–134.

[21] J. W. Thomas, *A Review of Research on Project-Based Learning*. Autodesk Foundation, 2000.

[22] B. S. Bloom, *Taxonomy of educational objectives: The classification of education goals by a committee of college and university examiners*. David McKay, 1956.

[23] L. W. Anderson *et al.*, *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives, Complete Edition*. Pearson, 2000.

[24] P. Black and D. Wiliam, 'Developing the theory of formative assessment', *Educational Assessment, Evaluation and Accountability*, vol. 21, no. 1, pp. 5–31, 2009.

[25] L. A. Shepard, 'Formative assessment: Caveat emptor', in *ETS invitational conference the future of assessment: shaping teaching and learning*, 2005, pp. 279–303.

[26] L. Lagerstrom, P. Johanes, and U. Ponsukcharoen, 'The Myth of the Six-Minute Rule: Student Engagement with Online Videos', in *Proceedings of the American Society for Engineering Education*, 2015, pp. 14–17.

[27] M. Liu, J. Kang, and E. McKelroy, 'Examining learners' perspective of taking a MOOC: reasons, excitement, and perception of usefulness', *Educational Media International*, vol. 52, no. 2, pp. 129–146, 2015.