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A Model for the Integration of Podcasts (Audio or Video) in an E-learning System

ABSTRACT

Today, podcasting is an easy way to distribute content via the Internet to mobile devices (smartphone, laptop, tablet, etc.). Our problem concerns the analysis of the effect of integrating podcasting into a distance learning device. Numerous initiatives for the development of educational content are currently emerging in the context of university education (Dale et al., 2009). To guide their design and integration into a training perspective, however, pedagogical reflection is necessary. In our contribution, we would first like to describe how podcasts have been implemented in the Faculty of Psychology and Educational Sciences of the University of Mons. Based on an experimental design, our paper will also evaluate their effectiveness by analyzing the performance of learners who benefited from the device compared to learners who did not use the device, as well as the learners' opinion about their learning experience.

Keywords: Mobile learning, learning support, podcast, educational scenario.

Podcasting

Definition

The term podcasting is a neologism that comes from the contraction of the terms "iPod" and "Broadcasting". They have been combined to indicate that the content of the iPod (or any other mobile device supporting MP3 or MP4 formats) is fed on a regular basis via a feed aggregator (such as Apple Music,

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Spotify, etc.) which integrates and updates audio and/or visual information made available using RSS-type technologies (although this term is no longer as appropriate as it was when podcasts emerged). Technology allows selection and then automatic download of the news content that users want. Every new version, every new episode is offered to the user who has subscribed to a feed, to a channel. They do not have to search for the information, it comes to them because they have expressed an interest in it at a given time by subscribing to the feed. Today, practically all radio stations offer podcasts so that listeners can (re)listen to their programs at any time they wish, wherever they are.

Podcasts, which originally only included audio files, can now include images, videos, and other sequences. This technological development has led McCombs et al. (2007) to distinguish three podcast formats: audio podcasts, video podcasts (which are the most common), and mixed podcasts (which combine different types of media, audio or not, images, animations, and video sequences).

Podcasting in education

Podcasts have become a means of disseminating information that concerns all sectors of activity: radio stations as well as press organs have appropriated them. Higher education institutions, including universities, have not been left behind, as shown by the number of courses that were once available on iTunes U[3] (for University). English-speaking universities were very active from the outset, and today more and more French-speaking universities are also using it as a tool for disseminating knowledge and promoting their institutions. If the fashion effect has somewhat passed, it is nevertheless true that today many institutions continue, either systematically or on an ad hoc basis, to disseminate recorded content that is accessible internally, but also in a broad and open manner, as the initial philosophy of podcasts had envisaged. COVID-19 pandemic, which for two academic years disrupted the traditional course of face-to-face teaching to give a larger place to distance learning, has enabled many teachers to (re)discover the virtues of these recordings and their mode of dissemination, whether it be their own production or that of colleagues or other training professionals.

Many advantages are attributed to the use of podcasts in a pedagogical context: one of them, which is often mentioned, is that it allows the student to approach the content at his or her own pace and to return to it as often as nec-

[3] https://www.open.edu/itunes/ (as an example)

essary. Others see it as an opportunity to prepare the student before the lecture and thus increase the degree of face-to-face interactivity in the lecture session. For example, in medicine, podcasts can be used to present situations that are the discussion leads. These podcasts can also be used to provide students with summaries or syntheses after the course (or instead of it), which do not require the student to view the whole course, but rather a structured summary of its important elements. According to Evans (2008), being able to study by replaying parts of a lecture can reduce students' anxiety during exam periods. Fernandez, Simo and Sallan (2009) point out that podcasts offer a better overview of the material to students. The podcast can also be used to make a process explicit or to facilitate the use of specialized tools. Before starting laboratory work, video commentaries can be made available to show learners how to use a particular piece of equipment or how to follow health and safety instructions.

Authors such as McCombs et al. (2007) or Maag (2006) see podcasting as a tool with great potential for learning. We consider that these possibilities are linked to the way the information is accessed, the way the information is structured and the purposes for which the mediated material is used.

As regards access to information, following the example of Ola and Niclas (2005), we believe that RSS technology greatly facilitates the learne's task. Indeed, the user is no longer obliged to go and look for information but can subscribe to an information feed which is automatically updated on his mobile device (computer, tablet, smartphone, etc.). Regarding this ease of dissemination, Lee, Miller & Newham (2009) highlight the fact that students are still not very well informed about the possibilities and facilities offered by this form of communication. It should be noted, however, that it is now much more transparent in its activation, whereas in the past it sometimes required several operations to implement it.

In terms of information structuring, podcasting offers multiple possibilities from text-only or audio information to information enriched with a combination of different communication channels. For example, the learner can be offered a structuring of information using different media (audio, images, animations and videos), the order of which can be left to the learner's discretion or, on the contrary, imposed as to take into account the human and technical means available.

Regarding the purpose of the material, a distinction can be made between two types of possible use of the podcast: spontaneous use and integrated use. Spontaneous use is the most frequent. It corresponds to the situation where the podcast is made available in parallel with the classroom course. The learner is not given any specific instructions on how to use it. The learner therefore

u s i e f t r e æ c l o y o r t d o h i n s g e T l s t e r s e e c c o b n s i m d a y e a d o b s e n c e
from class. It should be noted that Deal (2007) and McKinney et al. (2009) have pointed out that attendance in class does not decrease if the podcasting provides different information from that given in the course. The need may be to revise aspects of the course that are less appropriate (Fernandez et al., 2009). Finally, the learner may personally pursue an area of study covered in the course. In this type of use, McKinney et al. (2009) also highlight the fact that the medium encourages students to check and structure their lecture notes.

In the context of an integrated use, the provision of the podcast is thought out by the teacher to serve his or her pedagogical objectives. A typology of the f u n c t t h a t h s e o d c c a a s f n t u l w f i l b l e a v a i s l a b o r i e a p y u b l i c a t i o n in progress (Decamps et al., n.d.). However, it is already possible to mention some of them. The podcast made available to learners can be considered as:

- a motivational trigger to make the learner want to go further;
- a set of organizational information to explain the course;
- the content to be understood to deal with it during the course, it is then the main object of the session;
- an illustration of a point of the course which will be described here, detailed to go further in an explanation;
- a different, complementary explanation by another teacher or a renowned e x p é m h e e l d ;
- etc.

D e p e n d i v h e t h e u r l o r l e f s h e (s o e r t h e u r) c t t i h p e o d c a s t is offered either as an initial situation, as the "body" of the learning session, or as used at the end of the session. The material developed serves as a support for the teaching activity and thus constitutes a learning object. It enables a series of activities to be initiated with a view to reinvesting the content discovered in the podcast. This decontextualization approach is conducive to the transfer of knowledge. In the last case, that of using the podcast at the end of the sequence, s e v e p r o a s l s i b e i x l i a s f t h i a p e o d c c a a s m t e p r o p o a s s e r e d x , e r o c a i n s e evaluation, as an object of analysis (of the case study type) through which the students testify to their understanding of the course. It can also be a summary of the content by the teacher or an expert to close the sequence. And the student himself/herself can be the creator of a podcast which, at the end of a sequence, s e r v e a s a n a p r o d u c t y n t h r e e s f i e s c a t n i a o l n y , s l o n t s h , c i a s t h e , e s t u d e n v t e c o p e a s t k i v i e t l e s r o n s t i g p t e a d u a n t f o o n h s i - m self in a position of actor rather than receiver. The podcast is, therefore, an opportunity to process and appropriate content while making it available to

other learners, which is undoubtedly to be encouraged from our point of view. The creation and publication of podcasts by students is also highlighted as an effective activity (Dale & Pymm, 2009; Lazzari, 2009).

Our typology of podcast use is illustrated in Figure 1 below and consists of two axes. The first, horizontal axis concerns the structuring of the medium which considers, at the extreme left, the situation where the structuring of the podcast is practically nil insofar as the entirety of the teacher's lecture is only filmed without any particular structuring (as is usually the case in universities), and at the extreme right the lecture has been structured in such a way that it highlights the essential points of a given lecture in forms that may be very different from those of the face-to-face lecture and very strongly illustrated by diagrams, tables, illustrations and video sequences. The vertical axis concerns the mode of use. It extends from spontaneous use (lower end) by the learner who listens to or views the podcast if and when he or she wishes without any particular instruction from the teacher. The upper end of the axis represents the integrated use of the podcast in an instructional sequence designed by the teacher in which the learner is expected to view the podcast at a certain time. In this way, the student processes the information contained in the podcast to invest it in an appropriation activity

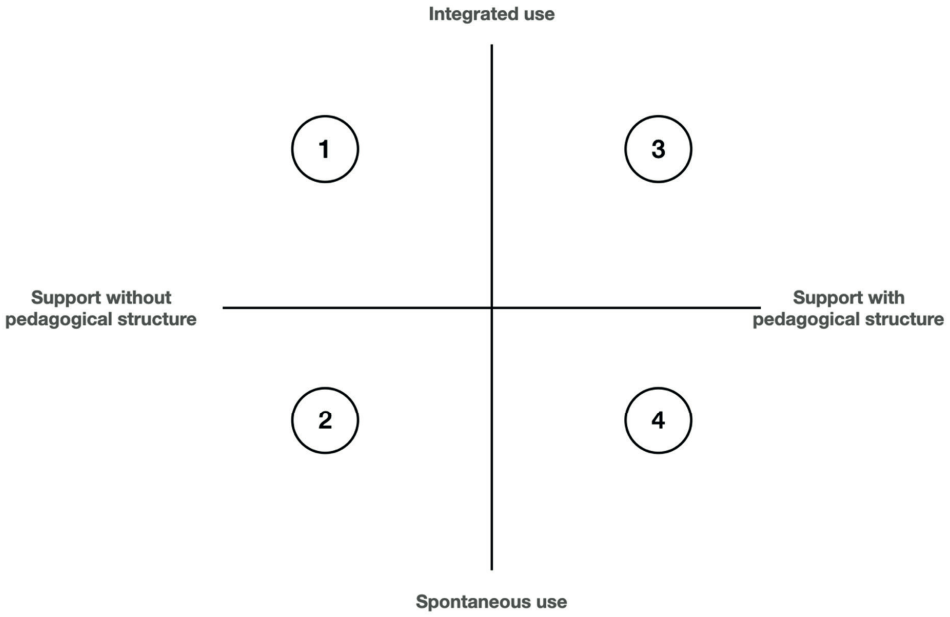

Figure 1. Digital media integration model

Source: Authors' own elaboration.

and reports on the degree of appropriation of the content. The intersection of these two axes makes it possible to visualize four pedagogical situations where podcasting is used.

The two situations that we will assess in the following are located in zones 3 and 4 of the figure 1 where we have a video commonly called podcasts structured to deal in a synthetic way with 6 themes of a general education course. The difference between these two zones will be linked to the vertical axis: some of the learners see the podcasts integrated into a pedagogical scenario (zone 3), while other subjects are simply offered to use the podcasts according to their inspiration, need, desire... in short, in a spontaneous manner without any particular instructions (zone 4).

Example of integrating podcasts into a teaching scenario

Integrated use

The pedagogical scenario of the project in which the podcasts are integrated is based on two phases of appropriation structured by several tasks envisaged to mobilize the learner cognitively (D'Hainaut, 1983). The table below details

Table 1. Learning scenario for the integrated podcast

	Nature of the task	**Modalities**	**Objectives**	**Additional tools**
Stage 1	Exploration	Individual	Identify the key concepts presented in each podcast Justify the choice of key concepts with a thorough argumentation	Groupware
	Conceptualization	Individual	Establish possible links between concepts discovered in different podcasts	Groupware
Step 2	Problem solving	Individual	Analyze different case studies using the concepts discovered in the podcasts	Groupware
		Collective	Write a joint analysis of these case studies	Groupware Cat Forum

Source: Authors' own elaboration.

(individual vs. collective) and the tools favored in the learning environment.

The scenario described below (Table 1) highlights how the tools integrated into digital working environments can be made complementary: podcasts provide information in a dynamic way but have little interactive capacity. The communication tools (chat – forum) make interactions possible so that students exchange information about the content of the podcasts and the groupware allows users to upload documents in order to complete the task based on the podcasts.

Spontaneous use

Spontaneous use of podcasts is when learners are free to access the podcasts whenever and however often they wish. However, it should be noted that the point in their learning process. These students had a traditional lecture combined with collaborative practical work, the aim of which was to enable them to mobilize the concepts in different case studies. The podcasts were made available to them after the course in preparation for their exams.

Research questions

To evaluate the effect of podcasts on learners' performance, we analyze the results of a group with podcast resources integrated into a learning scenario and a group without podcast resources. The analyses carried out focus initially on what students retain when the learning object consists of podcasts integrated into a learning scenario. These results are put into perspective with those of learners whose learning scenario is not structured around podcasts, but rather around other concept integration activities. This analysis allows us to highlight

in a learning scenario with podcasts on the one hand and in a learning scenario with other learning resources than podcasts on the other hand (Question 1)?

To take into account learners' opinions on the use of podcasts, we offered them an online questionnaire to express their opinions on this subject. We therefore considered the opinions of learners who had used the podcasts as part

of the teaching scenario and those who had used them spontaneously outside the teaching scenario intended for them.

What are the perceptions of learners who have used podcasts as a learning aid as part of an educational scenario on the one hand, and from podcasts used spontaneously on the other hand (Question 2).

Our sample consists of 28 students, 14 who used the podcast in the integrated scenario (these are all the students who were integrated into the planned scenario) and 14 who made spontaneous use after having completed the assessment of their degree of mastery of the concepts (these are 14 students who have a similar learning style to those who used the podcast). These professional secretarial students (n = 28) attended the same course.

Analysis device

The approach implemented is marked out in 5 phases as illustrated in Table 2 below.

Table 2. The 5 phases of the process

Phases Groups	1. Pre-apprenticeship	2. Learning phase	3. Performance Analysis	4. Provision of resources	5. Analysis of students' perceptions
Integrated podcast	Questionnaire on learning styles	Podcasts integrated into the script	Assessment of the degree of mastery of the concepts	Written course materials	Online opinion questionnaire
Spontaneous podcast		Face-to-face courses + Course materials	Assessment of the degree of mastery of the concepts + Learning styles questionnaire	Podcasts for spontaneous use	Online opinion questionnaire

Source: Authors' own elaboration.

In the first phase, we collected information about the characteristics of the learners in the integrated podcast group via two online questionnaires: one positioning them according to Kolb's learning styles and the other establishing the degree of mastery of the concepts (Dieng, Garand, 1997).

students in the "spontaneous podcast" group were not given a task to complete during this phase.

The second phase is where the learning itself takes place. The students in the "integrated podcast" group carried out the activities provided for in the learning scenario that incorporates the use of podcasts. No other course resources were provided at this stage. The students in the "spontaneous podcast" group carried out their learning (see the learning scenario described in Table 1) with all course resources (lectures, notes, etc.) except for the podcasts.

The third phase of the experimental approach consists of evaluating how the content of the podcasts was appropriated by the learners. An identical post-test was administered to both student groups. The items of the post-test are designed considering the taxonomic model of D'Hainaut (1983). Three levels were considered: reproduction (e.g., quoting facts and concepts explicitly present in the podcast), application (e.g. implementing principles and procedures mentioned in the podcast, but presented in a new situation) and mobilization (using a given pedagogical concept, proposing an example of implementation). Consideration was given to several learning styles in order to measure learners' achievements. During this phase, questionnaires on learning styles were also administered to the students in the "spontaneous podcast" group.

The fourth phase is to provide students with learning materials that they had not previously had access to. For example, students who had access to the embedded podcasts were given access to the course notes (syllabus, slide shows, glossary) and students who had not previously had access to the podcasts were given the opportunity to view the podcasts.

Finally, the fifth phase is to collect students' perceptions of the podcast tool. We administered an online opinion questionnaire to students in both groups.

It is therefore important to remember that question 1 considers one group that has used podcasts and the other that has not, while question 2 looks at the perception of those who have used it in their learning scenario and those who have used it spontaneously because of learning activities.

Analysis of the results

Effects on performance (Question 1)

In terms of performance, we will highlight the results obtained as a whole, those distinguished according to the taxonomic levels (reproduction, application, and mobilization) and those distinguished according to the underlying pedagogical strategy implemented (deductive approach vs. inductive approach).

Overall results

In Table 3 below, we can see that the comparison of average performance on the post-test, the score of the learners in both groups is relatively low (51.07% and 21.02%, respectively), but that there is a significant difference between these two groups.

Table 3. Overall results

Groups	N	Average (%)	Coefficient of variation
Integrated podcast	14	51.07 %	32.76 %
Without podcast	14	21.02 %	44.84 %

Source: Authors' own elaboration.

We applied a test to see if there is a significant difference between the two average scores, and the analysis revealed a significant difference with a high effect size ($t = 5.18$; $p = .000$). These differences can be explained by the training schemes implemented. The students who carried out activities other than those centered on podcasting did not go into the content covered in the same way. This is not surprising, especially since the questionnaire administered to assess the degree of mastery, which was identical for both groups, focused on the issues and specific aspects addressed by the podcast. This result is in line with the work of Depover, Karsenti and Komis (2007) concerning the use of a tool with cognitive potential within a training course, i.e., that a digital tool can lead students to acquire high-level competences if it is correctly integrated into the pedagogical scenario, we can see here an effect of this kind.

However, while this effect is positive in the case of the scenario that integrates the podcast, we should not interpret the opposite for the scenario that does not integrate the podcast. Indeed, this scenario implements other skills through

other activities whose relevance in terms of performance should be evaluated. It should be borne in mind that the evaluation that was carried out focused on the potential added value of podcasts. And if these characteristics are clearly better understood in the case of the scenario that includes podcasts, and less so by those who have not obtained the expected results, we conclude that the latter scenario is superior to the other in terms of the pursuit of the course's objectives. This result, which is also consistent with Dale's (1969) theoretical model. The latter shows that recall of information increases as the learner's level of activity increases through a diversity of learning experiences. In our study, we can consider that the interaction between the task and the use of a mediated medium seems to be beneficial for learning. Among the explanations that could explain these differences can be attributed to the fact that for the students in the scenario with podcast, it is a question of immediate retention of information in contrast to the learners who do not have the scenario with podcast for whom the information from the courses and the associated activities is more distant in time.

Results according to taxonomic levels

Regarding the results according to taxonomic levels, we can establish the same findings as those mentioned above. In fact, they are relatively similar, whether the courses in which podcasts are integrated into the teaching scenario. The differences are significant between our two groups (t replication = 4.09; p = 0.001, t application = 4.75; p = 0.000 and t mobilization = 5.51; p = 0.000). The differences between the two groups can be explained by the fact that the students did not have to perform the same tasks in their respective scenarios. It should be noted that the overall success rate is still relatively low (barely 50%). We can consider that the podcasts are complementary course materials, but that they are certainly not sufficient in themselves to allow students to acquire a high degree of mastery of knowledge. It is also interesting to observe that the results of the learners in the group of podcasts are more homogeneous at the levels of application (coefficient of variation: 37.58%) and mobilization (coefficient of variation: 31.87%) than the results of learners who did not have access to podcasts (application: 71.42% and mobilization: 87.75%).

Table 4. Results by taxonomic level

Groups	N	Taxonomic levels	Average (%)	Coeff. of variation (%)
Integrated podcast	14	Reproduction	56.10 %	43.89 %
		Application	50.04 %	37.58 %
		Mobilization	51.90 %	31.87 %
Without podcast	14	Reproduction	28.00 %	25.54 %
		Application	20.79 %	71.42 %
		Mobilization	18.18 %	87.75 %

Source: Authors' own elaboration.

Results according to teaching strategies

Of the six podcasts offered to the students, four podcasts were built on a deductive reasoning mode while the other two were built on an inductive approach.

Table 5. Results by mode of reasoning

Mode of reasoning	Average (%)	Coefficient of variat
Inductive podcasts	44.33 %	43.82 %
Deductive podcasts	33.33 %	34.17 %

Source: Authors' own elaboration.

Although we observe that providing learners with examples beforehand so that they construct the concept by gradually moving towards a more general level (inductive podcasts: 44.33 %) tends to promote better learning than the opposite (deductive podcasts: 33.33 %), no statistically significant difference from a statistical point of view (t = .726; p = .481) between the two reasoning methods. This result is, however, in line with the work related to the transfer of learning, which stresses the importance of the process of decontextualization of knowledge likely to effectively guide its reuse in new situations where it must be mobilized (Tardif, 1997).

Effects on learners' perceptions

We collected learners' opinions about their learning experience by means of an online questionnaire administered on the one hand to learners who had made integrated use of the podcasts and on the other hand to students who after the

post-test used the podcasts spontaneously (phase 5). The questionnaire was composed of different items built on a Likert scale. It allows students to express their opinion about statements on a 4-level scale: 2 negative (Strongly Disagree and Disagree) and 2 positive (Agree and Strongly Agree) except for item 1.

Terms of use of the podcast

With the help of item 1, we were interested in how the students used the podcast.

Table 6. Modalities of use of the podcast

	Types of use	**Yes**	**No**
Item 1: I have watched one or more podcasts of the course on an iPod or portable media player.	Integrated	14.3 %	85.7 %
	Spontaneous	35.7 %	64.3 %

Source: Authors' own elaboration.

Table 6 shows that use of mobile media is relatively low. This observation is in line with those of Lee, Miller & Newham (2009) who point out that students are generally unaware of the different ways of using this type of media. Finally, we can see from the table that it is the students who have integrated use who use the computer exclusively (85.7%). In our context, this preferential reading on the computer for these students is quite logical given that the various tasks requested in the environment require parallel work using a word processor.

Relevance of podcasts

Table 7. Relevance of the podcast

Items	**Types of use**	**Strongly disagree**	**Disagree-ment**	**I agree**	**Totally agree**
Item 2: During my first viewing, I understood the whole theme developed.	Integrated	0.0 %	35.7 %	50.0 %	14.3 %
	Spontaneous	0.0 %	0.0 %	50.0 %	50.0 %
Item 3: I understand the concepts that have been developed in the podcasts better than the other concepts in the course.	Integrated	0.0 %	35.7 %	42.8 %	21.5 %
	Spontaneous	0.0 %	35.7 %	35.7 %	28.6 %

Items	Types of use	Strongly disagree	Disagree-ment	I agree	Totally agree
Item 4: Concepts are easier to understand in the podcasts rather than in the glossary.	Integrated	0.0 %	21.4 %	50 %	28.6 %
	Spontaneous	0.0 %	28.6%	35.7 %	35.7 %
Item 5: I found the information presented in the podcast to be well structured.	Integrated	0.0 %	7.1 %	78.6 %	14.3 %
	Spontaneous	0.0 %	0.0 %	50.0 %	50.0 %
Item 6: Podcasts are a useful support to the course.	Integrated	0.0 %	7.1 %	35.7 %	57.1 %
	Spontaneous	0.0 %	0.0 %	28.6 %	71.4 %
Item 7: Podcasts are a more motivating source than the traditional syllabus.	Integrated	0.0 %	35.7 %	50.0 %	14.3 %
	Spontaneous	0.0 %	28.6 %	21.4 %	50.0 %
Item 8: I like podcasts because they allow the presentation of information in different ways.	Integrated	0.0 %	7.1 %	64.3 %	28.6 %
	Spontaneous	0.0 %	7.1 %	57.1 %	35.7 %

Source: Authors' own elaboration.

Overall, we can see from table 7 that learners have a positive perception of the relevance of podcasts, regardless of the context in which the medium is used (spontaneous vs. integrated). We can consider that this positive opinion of the media can contribute to the effectiveness of learning dynamics. Some nuances appear, however, if we compare the opinion of learners who have used the medium spontaneously with that of learners who have had an integrated use of the medium, which is also instructive, regarding item 2 (immediate comprehension) and item 5 (structuring of the podcast). Regarding item 2, spontaneous use following the course leads students to consider that understanding podcasts is more difficult than learners who have not had the course beforehand ($p = .008$). A prior learning experience helps to explain the difficulties in appropriating this form. That is also linked to complementarity (face-to-face and podcast) is also highlighted in item 5, where learners with spontaneous use rate the structuring proposed in the podcast more positively than learners who did not have the face-to-face course ($p = .0038$). These differences in opinion lead us to believe that the discovery of the podcast offers learners a situation conducive to activating and reorganizing the knowledge covered in the face-to-face course. This hypothesis is consistent

with the actual use by learners of podcasts in spontaneous mode. As the exam approached, students increasingly used the resources made available to them (see Figure 2). This behavior is consistent with Evans (2008) who found a link between reduced anxiety and podcast use during exam periods and McKinney et al. (2009) who found that podcasts stimulated students to reorganize their lecture notes.

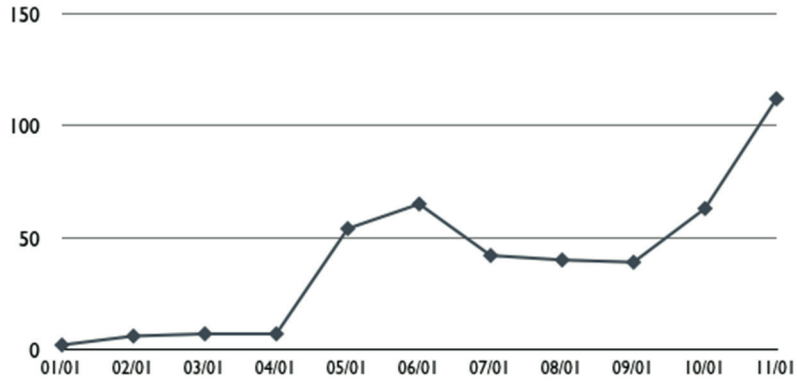

Figure 2. Evolution of connections to the podcast site during the exam preparation period
Source: Authors' own elaboration.

These results lead us to believe that the relevance of the podcast in an academic context probably lies more in the restructuring of information than in a course of sense added by the production in the form of a podcast. This discourse support, which is complementary to the lecture notes, thus gives the teacher the opportunity to differentiate the learning processes of his students (Perrenoud, 1995).

Conclusions

Our results show that the added value of the podcast lies in the pedagogical exploitation of the complementarity of the sources of information, but also in the necessary integration of the principle of activity dear to constructivists by appealing to the cognitive mobilization of the learner. If the mediatization of information appears to be a real challenge, the question of mediability seems to be just as important. Our recommendations are therefore in the direction of a pedagogical effect that must integrate the learner in a logic of driving

t omou cihm p o r tt aa r e c c e h n a t b e g x y p e o n f s e e f e c o t w i h o a n t e a l l y creates the quality of learning. In terms of perspective, it may be interesting to investigate further how learners appropriate the information provided in a podcast depending on the nature of the media used (multimedia vs. audio). To evaluate the combined effect of learner activity, we also believe that it would be useful in future studies to cross-reference this variable relating to mediatization with the mediation modalities relating to the presence or absence of activities for mobilizing the information contained in these podcasts.

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