Activity Theory as a theoretical framework for the study of blended learning: a case study

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Abstract

The present paper examines the contribution of Activity Theory to the study of blended learning. In the first part of the paper we discuss blended learning and conclude that novel practices, activities and tasks are required to avoid replicating current transmissionist practices. The second section includes a brief outline of Activity Theory and considers how it can be used to study innovations. In the third section a case study involving 22 undergraduate preschool education students who attended a blended learning course is presented. Surveys, interviews, and field notes were used to determine how students used the online resources provided and why. Data analysis revealed that students made minimal use of the resources and Activity Theory helps conceptualize and explain student patterns of activity.

Keywords

e-learning, Activity Theory, Learning Management Systems, Log file analysis

Innovative practices for e-learning

Over the past decade we have witnessed the growing popularity of blended learning, as both distance and conventional tertiary education courses have acquired an e-learning component. The great promise of blended learning lies in its potential to combine the best of traditional and online practices (Thorne, 2003). Blended learning provides opportunities to foster reflective thinking, facilitate communication and collaboration, increase student engagement with the subject, enhance contextual learning, extend the course in space and time, increase flexibility, provide opportunities for engagement depending on the pace of the student, help the construction of knowledge through communities of practice, establish the much-needed authenticity, and promote learner control (Naidu, 2003; Bonk, Wisher & Lee, 2004; Khan, 2005; Clark & Mayer, 2008).

However, as the history of educational technology vividly demonstrates, the opportunities afforded by technologies are not always opportunities taken. E-learning does not appear to be an exception to this rule. For example, typical e-learning approaches tend to replicate traditional transmissionist practices which are fairly didactic and are mostly based on behaviorist conceptions of learning (Naidu, 2003; Phillips, 2006; Conole et al., 2007; Littlejohn et al., 2007). On the other hand, the provision of online resources does not necessarily lead either to their actual use (Nachmias & Segev, 2003) or to the adoption of appropriate learning strategies for their use (Ellis, Marcus & Taylor, 2005). Thus, in the case of e-learning educators face major challenges which are both multifaceted and complex (Clark & Mayer, 2008; Bonk, Wisher & Lee, 2004). As is often the case with technology in education, one of the most significant challenges the educators face is pedagogical in nature.

As traditional pedagogical practices cannot be adopted in e-learning, novel practices, activities, and tasks need to be developed, validated, and implemented. Given that there are no recipes, innovation and experimentation are essential for the successful integration of e-learning into educational practices. Moreover, a theoretical framework which will enable the systematic study of innovation in technology-rich environments - such as e-learning contexts – is required. This is the focus of the next section which considers Activity Theory and its potential contribution to the study of e-learning.

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Activity Theory and the study of innovation

Activity Theory (hereafter AT) is a promising theoretical framework for the study of tensions in an activity system. Developed initially by Leont'ev (1981), in its current expanded form, namely Cultural-Historical Activity Theory (Cole, 1996), it provides an indispensable theoretical tool for understanding conflicts, friction, contradictions, and inconsistencies both between and within the components of an activity system (Engestrom, 1987; 1999). An activity system and the layout of an established human practice is conceptualized in terms of certain components which are depicted in figure 1.

We propose that for any given activity system, like traditional tertiary education, where a major innovation is introduced, such as blended learning, AT is an ideal tool. It allows the researcher to conceptualize what works and what does not in the innovation, what impedes change, at what level and in relation to which factors. Essentially, AT provides the researcher with a tool to study the reconfiguration of practice as a result of the introduction of the innovation. What is more, the knowledge gained from this study can be further applied to the improvement of the practice.

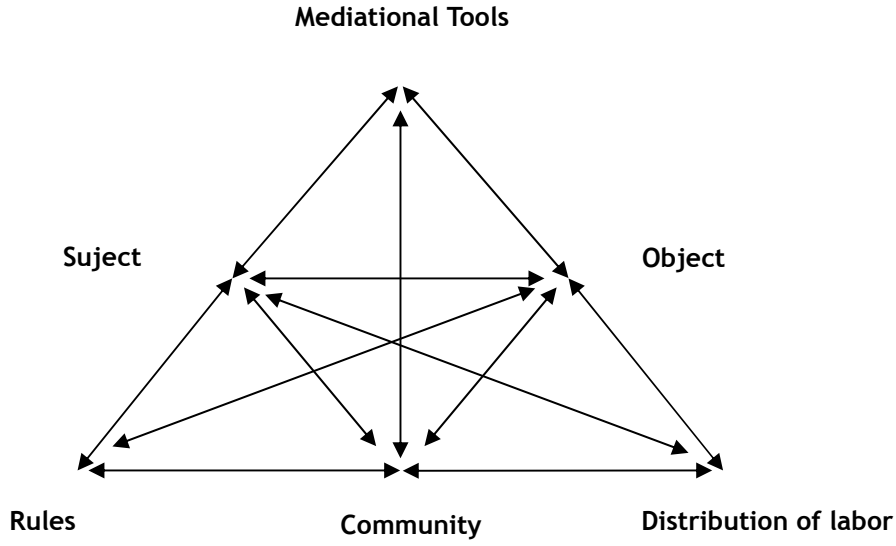

Figure 1: Depiction of the main components of an Activity System

AT has been used as a theoretical framework in studying the design and development of technology-enhanced courses (e.g. Barab et al., 2002; Scanlon & Issroff, 2005). When it comes to e-learning, we are aware of studies which have focused on the tensions arising from e-learning implementations but without explicit reference to AT (e.g. Duffy & Kirkley, 2004). On the other hand, there has been some speculation about the use of AT as a theoretical framework for e-learning (Oliver et al., 2007; Dyke et al., 2007) as well as attemps to embed it in e-learning tools (Joyes, 2006). Thus, to our knowledge, AT has not been systematically applied to the study of blended learning.

Background and focus of the study

The data reported in this paper are derived from a larger ongoing design research project which focuses on blended learning and more specifically on how a Learning Management System (LMS) can be best integrated into conventional tertiary education practices. The research project commenced in 2005 when blended learning was introduced in the four courses that the author taught in a preschool education department at a Greek University. The first year of the implementation was characterized by a very minimal LMS use by students (e.g. course outline, schedule, lecture materials). Based on the findings of the first year implementation, all four courses were redesigned so as to engage students more actively in blended learning. Due to space limitations, the present paper focuses on the second-year implementation and examines how and why students used the online resources provided in a single undergraduate blended learning course. The paper addresses two main questions:

(a) *what is the use of online resources by the students?*
(b) *how can this use be explained through AT?*

Method

Subjects

22 undergraduate students participated in the study. All students had enrolled in the course "Design and Development of Educational Software" which the author taught in the 2007 spring semester. All students were blended learning novices as they had never used a LMS in the past.

Course Content

The course was elective and it was intended for senior students only. The main objectives of the course were (a) to make students able to process various digital media formats, and (b) design and develop an educational multimedia application. To this end, the course was comprised of seven modules: multimedia learning, interface design, processing of bitmap and vector graphics, digital audio, digital video, and multimedia authoring. The first two modules addressed concepts while the others mainly focused on the development of software skills. Students were expected to master the basics of four free and open source software (FOSS) applications, namely Gimp (bitmap graphics), Inkscape (vector graphics), Audacity (digital audio capture and processing), VirtualDub (digital video capture and processing) as well as one freeware program, Multimedia Builder (multimedia authoring).

Since the course was the only digital media one offered in the department, the students had virtually no formal prior familiarization with the software applications or knowledge of the concepts involved (e.g. color depth, graphics formats, audio and video codecs, scripting). The course was a typical semester course expanding over 13 weeks with 3 hr sessions per week. Students were expected to work in small groups (of 2-3 members) to design and develop a small-scale multimedia application on an educational topic drawn from the official preschool education national curriculum (e.g. means of transportation, seasons etc). The main course deliverable was a group-level one and included the development of an educational multimedia application which was due at the end of the course. The course was concluded with a presentation of the multimedia application and a discussion which focused on whether the students had actually implemented the multimedia learning and interface design principles covered in the course. If the multimedia applications delivered by the students were not judged to be up to standard, the students were asked to make all the necessary modifications.

Provided that only a certain amount of material can be covered in class, blended learning emerged as an ideal option for enriching the course content by means of online resources. Moodle, a free and open source web application, was used as the LMS which hosted the course. Three types of online resources were included in the online course: (a) course materials (lecture notes, papers, web links), (b) course assignments (instructions, examples, sample scripts, videotutorials), and (c) forum (for course news, questions, discussions and other activities).

Measures & Operationalization

Data sources included surveys, group interviews, web server log files and field notes based on informal observations, discussions and remarks made throughout the course. More specifically, students completed an online questionnaire which measured their former ICT experience and attitudes towards computers. Secondly, short 20 minute semi-structured group interviews were conducted by the author. Finally, the use of online resources was examined by looking at the log files which were recorded by Moodle.

We have operationalized "use" of an online resource through "view" of online resource. It is obvious that to use a resource a student must first view it, namely load it in their web browser. However, this operationalization has limitations for it is not possible to know what the students actually did with the resource, whether and how they studied it, why they loaded it, how conducive to learning they they perceived it to be, what their understanding of the resource was etc. By looking at log files all one has access to is essentially access patterns in the form of resource views. It is impossible to infer anything else on the basis of log file information alone. Nevertheless, viewing a resource is a definite

precondition to actually using the resource. Thus, even though the use of log files is a very rough measure of actual resource use, it is sufficient for our purposes. It appears that the use of log files as a method for the study of e-learning has recently attracted attention and it appears to hold great promise (e.g. Nachmias & Segev, 2003; Lam et al., 2006; Phillips, 2006).

Procedure

In the beginning of the course, students were instructed to create accounts and log into the LMS. The use of the LMS was demonstrated and students had a short practice session (e.g. posting questions and remarks in the forum, downloading materials, uploading assignments, viewing online resources). Students used the LMS throughout the course and all relevant activity was logged automatically by the LMS. Students completed surveys both before and after the course while group interviews were also conducted after the end of the course.

Analysis

We used log files to extract all information patterns of student access (frequency, time, and location) as well as use of online resources (i.e. which specific items were used by each student, when, and from which location). When we first inspected the course related hits, we came to the conclusion that the log file presented a very inflated picture with redundant information. This was due to the way Moodle is configured to log student actions. As is usually the case with log file data (e.g. see Phillips, 2006), a transformation of the data to make it more usable was required. Firstly, all administrative activity (i.e. log file entries by the course instructor and the teaching assistant) was discarded from further analysis. Secondly, we skipped all user activity which was logged by the system but presented little interest such as general 'course views' (i.e. main course page listings which included links to all course online resources).

The information from log files was then combined with group interviews and other field notes to determine the students' perspective what on facilitated or hindered the use of the LMS. Following the AT methodology, student interviews were content analyzed to determine tensions which emerged throughout the blended learning experience, focusing mostly on the configuration of face to face and the online course components.

Results

Patterns of use of online resources

The log files were subjected to successive parsing to extract all relevant information, aggregating all views at the resource level. In total, the course included 56 online resources. Thus, if all students who attended the course were to view each resource only once, we would expect 1232 resource views at a minimum. Moreover, provided that it was impractical to save all the online resources to skip further viewing, we would expect well over 6000 resource views. However, contrary to expectations, the examination of the log files revealed only 1266 resource related views. What is more, 18% of the resources (10 out of the 56) were not viewed at all. Frequency counts and percentages of the most frequently viewed resources are presented in table 1. As including all 56 resources with very low percentage views would convey very little information, information is only provided for resource views with relative frequencies higher than 2%.

As can be seen from the table, the most frequently used resource was the forum which amounted to about 50% of the total resource views. While at first sight this might appear to be promising, it should be interpreted with caution. More specifically, the forum served three main functions: (a) news, (b) group formation (c) scenario posting. Firstly, news was a rather popular resource as students tried to keep up with the various course announcements. Secondly, the forum was used as a means to facilitate the formation of student groups on the basis of shared interest to undertake similar projects (e.g. domestic animals). Finally, the forum was used by student groups to upload the scenaria for the educational software applications they were expected to develop. We used the forum for hosting the scenaria because the files submitted were publicly accessible by all student groups as opposed to assignment submissions which were only viewable by the instructor. The fact that the formation of groups and the submission of scenaria were compulsory activities within the course context helps explain the increased forum activity which had very little to do with electronic communication per se.

Resource-Related Action	N	%
Forum	615	48,6
Lecture slides and notes	121	9,5
Multimedia Builder Scripts	64	5,1
Course Deliverables Schedule	63	5,0
Course Oral Exam Schedule	54	4,3
Course Survey	51	4,0
Course Outline	32	2,5
Course Software List	31	2,4
Animation Example	27	2,1
Other	208	16,5

Table 1: Frequencies of resources views

The second popular resource viewing activity was related to the course lecture slides and notes. As can be seen from table 1, about 10% of the overall resource viewing was closely related to course materials. Even though 56 resources were made available for the course, students appeared to concentrate on course materials. Interestingly enough, other materials such as online software guides and manuals did not receive much attention even though printed manuals were provided only for one of software applications covered.

As table 1 shows, the remaining of the resource views were also related to practical aspects of the course (e.g deliverables schedule, survey etc). What emerges from this table is a pattern of use which can be labeled minimal. Even though ample opportunities were offered in terms of (a) materials (56 resources) and (b) communication (asynchronous communication was offered as an option to pose course-related questions) students have not taken these opportunities to enhance their learning.

Activity Theory Analysis

The student interviews were content analyzed in an attempt to determine tensions both between and within the components of the activity system as a result of the incorporation of the LMS and the blended learning approach. This analysis revealed four main contradictions, mostly within components.

Tension #1. Within the Object of activity: What to learn
A first tension which emerged centered around the very objective of the activity system as students perceived it. Two different approaches were detected: one favoring the deep understanding of the concepts involved vs. another which was a surface-level approach and was geared towards passing the course. The former entailed studying for understanding, the latter studying for the exam. Students employing an understanding-based strategy reported viewing more recourses compared to students who were prepared to invest only the minimal effort to meet the course requirements. As one student who adopted a deep understanding approach put it: "*I checked out most [of the resources] because I wanted to make sure I didn't miss out something important. I knew they were put there for a reason and I visited most to see how they would help me with the [multimedia] project*" (Student-7). It appears that when the students understood that they could manage without viewing all the resources, only the more committed students actually spent time on viewing and studying the resources.

Tension #2: Within the Mediational means: How to learn
A second tension which emerged from the data set pertained to mediational means. More specifically, the blended approach to learning included information and communication resources. When the students were asked about the contribution of the LMS, most expressed positive views. Nevertheless, when it was

pointed out to the students that some of them had made minimal (or no) use of these two types of resources, they were more skeptical. The students explained that, in principle, they did not object to having a wide assortment of information recourses available. Neither did they find problematic the affordances of the forum to extend the class discussions in space and time. What they did report, however, was that the bulk of the material that was provided was extensive compared to other courses. It turned out that more material means a richer experience but also demands more effort to process it and it essentially amounts to spending more time overall. As student 4 remarked: "*I feel I've spent way too much time on this course already*!". While students did not object to the availability of material in terms of online resources, they were overwhelmed by the material. As one student explained, "*...visit all those links and study their contents?... that would mean that I would not graduate in July!*" (Student 19). Moreover, some students reported that the nature of the material, namely its digital format, posed certain restrictions in terms of handling as students had to go on-line to access it - which was not always convenient. Finally, some of the students complained that most of the resources were in English, a language with which they were not very familiar.

Tension #3: Within the Rules

The third tension which emerged some of the rules for the blended learning approach followed. Firstly, the students should use the LMS on a weekly basis, sometimes logging in several times a week - depending on the scheduling of deliverables. Secondly, students were encouraged (a) to study the digital materials provided through links on the course main page and (b) use the forum to pose questions and problems to the course instructor as well as discuss any issues which they deemed relevant. As students reported in the interviews, visiting the LMS on a regular basis to keep up with the course developments posed an extra burden for them. Given that it was their last semester before graduation, they had other commitments which included e.g. field work for their graduation projects. The students found it inconvenient to check the course web page very regularly. There were not accustomed to this timely keeping up with the course and this led to disruptions in their other engagements.

On the other hand, the students were instructed to pose any questions regarding the course to the forum. As opposed to asking questions in class only, students were provided with an opportunity to to pose questions in between classes. However, only a few of questions were posted throughout the semester and these were basically about extending the deadlines. The students reported that it was more practical to ask either the course instructor or the teaching assistant rather than posting questions in the forum. This was because only 36% of the students could access the net from home and 82% could access the net from other places. Thus, for students without easy net access, the use of the forum as a means to pose questions was not very appealing.

Tension #4: Within the Division of Labor

The final tension which emerged in the activity system was within the division of labor. As stated above, students should work in small groups of 2-3 to design and develop a small-scale multimedia application on a topic. Collaboration on the project was compulsory and the main course deliverable was a group and not an individual one. Collaboration was essential not only because it was too much work for any individual student to complete but because interaction was expected to foster the development of domain-specific knowledge and skills. The joint creation of a multimedia application required a great deal of collaboration on the part of the students. A shared product means shared responsibility for every aspect of its design and implementation and there were hundreds of decisions which had to be made. Students reported spending a considerable amount of time working collaboratively to develop their application.

It was observed that students formed groups based mostly on the basis of well established social relations (e.g. friendship). Quite often, the groups divided the work which had to be done. For example one group member would gather and process all the bitmap graphics required for their multimedia project while another member would make all audio recordings and processing. Collaboration within groups was not always easy and smooth, especially when the group members were not close friends. Still, tensions emerged even among friends. This was because some students ended up doing a lot of work and fulfilling their part of the deal while others followed a least effort approach. When problematic features of the multimedia applications were pointed out, some group members would without hesitation state that it was the job of someone else (i.e. another team member) who had done a "*poor job*".

Moreover, it turned out that the members of a group had different goals as far as performance on the

course was concerned. Some students wanted to excel, while others were content with passing the course. This was often reported by students as an error in group formation. Some students put in a lot of effort and expected a high grade while others invested less effort and did not really care about the grade so long as they passed the course.

Discussion

Data analysis shows that students adapted to the course requirements and used the online resources provided but only at a very minimal level. As the examination of the log files demonstrates, the most frequently viewed resources were related to what might be called a "*course survival strategy*": as a rule, students consult all materials which are essential for managing the course and essentially ignore the rest – no matter how relevant they might be. It appears that students complied to the requirements but did not go any further regarding resource views. In a sense, the students used the LMS as an online repository of materials which were required for passing the course. This minimal use clearly suggests low blended learning utilization. Therefore, we can conclude that not all learning affordances which were provided by the LMS were exploited.

The use of Activity Theory helped us understand these patterns of use of online resources in two ways. Firstly, the different approaches to learning that different students take mean that for some students the engagement with the materials will be very high and more online resources will be considered as more "*learning sources*". On the other hand, for some other students this is less likely to be the case. For such students, more online resources will be interpreted as "*more trouble*". What is promising is that blended learning has the flexibility to support both types of students while only the most devoted ones will benefit from it.

Secondly, "more" can be "too much" and be conveniently ignored by the students - especially if it is not very deeply integrated into the course requirements. While students appear to favor more material in terms of "more options", some students will simply not view the material. It appears that the majority of students will only view the online resources provided if these are deeply integrated not only into the course structure but - most importantly – into the course assignments. Again, blended learning can offer a very promising solution in this direction.

To conclude, a consistent pattern which emerged is that students only got to view online resources which were perceived to be compulsory. It is beyond doubt that such a behavior eventually means that students miss important learning opportunities and the impact of blended learning on student learning will remain fairly limited. The use of Activity Theory suggests that some important insights can be gained in studying blended learning.

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