Swapping Learning Management Systems: Self-Regulated Learning, Program Completion and Academic Achievement

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Abstract. An assessment was carried out of the effects of an online Learning Management System (LMS) switchover in a French university. For this assessment, the research involved three comparisons between the academic years before and after the switchover from Blackboard Learn™ to Moodle™. The comparisons were of 1. students' perceptions of use of regulation of learning strategies 2. rates of program completion 3. academic achievement. Participants were undergraduate students enrolled in their final year of a graduate program in education sciences. No significant differences were found in perceptions of regulation of learning although a slight difference in academic achievement was found. More significant were the differences in completion rates. Findings are discussed and recommendations are suggested for further exploration of online environmental features and designs and their relation to self- and co-regulation of learning, program completion and academic success.

Keywords: Self-regulated learning · Completion · Academic achievement · e-Learning · Learning environment

1 Context

In 2003, two French universities and the French National Center for Distance Education (*Centre National d'Éducation à Distance*, or CNED) finalized their agreement to implement education sciences online distance learning programs. Graduate and postgraduate studies have been open to students ever since. According to Albero & Simonian [1], the success of the online campus named *Formations et Ressources en Sciences de l'Éducation* (FORSE) is due to conceiving

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the learning environment as an ecosystem that involves the participation of all actors both to set the campus up as well as to maintain its long-term operation. To this end, an ecological approach was adopted. It included negotiating between partners three constituent parts: the technical choice of a Learning Management System (LMS) for permanent access by users; means and the approach to the production of learning materials as well as the way to address student tutoring; finally, the financial matrix including specifying provision in terms of the number of students to be enrolled in each diploma program.

The first LMS that was put to use was WebCT. The software was reliable and stable, although austere in appearance. Web pages with explanations for the students were added over time but using the bulletin boards required one to be computer savvy [20]. WebCT was later acquired by the company that owned Blackboard. It evolved into being Blackboard's LMS now known as Blackboard Learn™. Blackboard Learn was finally replaced by an implementation of Moodle™ starting with the academic year 2018–19.

An assessment of the effects of the switchover was proposed. It involved running a survey with students enrolled in the program leading to graduation in education sciences at one of the universities the year before the switchover and again after it took place. The survey was intended as a means to measure changes if any, in the ways students perceived how they conducted their learning. The theoretical framework that was used is Self-Regulated Learning (SRL). Program completion and academic achievement were also studied for the comparison.

The graduate program offered through FORSE is open to candidates who have already successfully completed the first two years of a higher education graduate program in the social sciences. Nevertheless, provision does exist, to enable people to access if they have completed a minimum of two years of preparation toward graduation in other fields and who can demonstrate sufficient professional experience in education, including participation in training within the field of education. The third and final year of graduate studies is the only graduate program provided on the digital campus.

FORSE also includes postgraduate studies comprised of a general first-year followed by two possible tracks to be chosen from for the completion of the postgraduate Master's degree. One track is geared toward instructional design and education consulting with studies lasting one extra academic year. The other track is geared toward research for which the completion of a stretched one academic year is to be completed over two years of further studies.

The bulk of students enrolled in FORSE programs follow the third-year graduate studies. In 2017–18, 662 students were enrolled through one of the two universities and 36 students followed the graduate program without enrollment through a university. The latter cannot attend exams and cannot obtain the diploma. In 2018–19, 700 undergraduates were enrolled through one of the two universities and 29 followed without enrolling at a university.

The number of enrolled students in the first-year of the Master's program was 194 and 225, during 2017–18 and 2018–19 respectively. Second-year Master's students enrolled in the instructional design and education counseling program

were 88 and 83 during each of these academic years respectively. Students enrolled in the two year research oriented program were 67 and 54 during the same years. The total number of students in 2017–18 was 1011, in 2018–19 students numbered 1062.

The research was conducted with participants from the graduate program enrolled at Lumière University (Lyon 2) where 418 students were enrolled in 2017–18 and 401 students were enrolled the following year, after the swapping of LMSs.

1.1 Swapping LMSs

The decision to switch from one LMS to another was the result of several considerations. CNED was in charge of providing and maintaining the technical infrastructure. The use of Blackboard Learn was licensed to CNED on Blackboard's servers. This was costly. While CNED was concerned with cost, academics at the universities were concerned with control over the digital environment. Control of the digital environment was thought to be essential as a means to break away from the initial educational model. The model was based on CNED's long-standing practices when textbook-style printed material, including exercises, were posted to distance learners before the Internet age. Completed exercises were then posted back to correctors to be assessed in an ongoing process of dispatching materials, receiving student work and returning feedback using postal correspondence. Similarly, the LMS used with FORSE was thought of initially as a distribution means of textbook material and a reception means of students' exercises to later be evaluated by correctors. The textbook material was written by academics from both involved universities and was updated every few years. The material took the form of down-loadable PDF files. Although this was the basis, instructional designs varied according to programs and tutor practices. Tutors also used other information and communication based technologies in accordance with their preferences and those of their students. E-mail and video-enabled chats were common. The model was perceived as outdated by academic personnel at both universities. The switchover was to provide an opportunity to engage partners in thought on conditions needed for these changes and for future adaptations.

Over the years, academics made ongoing requests to CNED for control over the appearance, ergonomics, choices, available services and digital provision in general. Resistance was met with frustration. The switchover was hence an opportunity to renegotiate the design of the digital environment. CNED had already made the choice to use Moodle™ as the backbone. This choice was met with acceptance as the LMS was familiar and recognized for its strengths. It has been widely used in French universities.

Setting aside considerations for more flexibility of the system in order to enable to progressively change ways in which the LMS was being used, the choice of services available to users, accessibility and ergonomic considerations were other issues that university staff wanted addressed. Once choices were determined, they

were to be implemented through the tweaking of the users' interfaces, to the degree that the LMS enables these design and ergonomic features to be adjusted. A small group of academic personnel from each university formed a think tank to discuss changes. They shared ideas with the steering committee of FORSE based on feedback from tutors and other educational staff.

Discussions lasted approximately one year. An ongoing struggle between the think tank members' wishes and the software team at CNED, who were using a sandbox to test the implementation, took another year before considering it ready for deployment. At the beginning of September 2018 the new LMS was ready and was operative.

A study to compare the ways students went about their learning, student program completion and academic achievement before and after the LMS switchover was suggested. This paper is a report of the outcomes of the study.

1.2 Previous research

A search for previous studies that had sought to compare the use of the same LMSs as in this study after a switchover uncovered only one paper [16]. Perceptions of faculty and students were studied primarily with regard to ease of use and satisfaction. Unfortunately, the study does not stand up to standards of scientific reporting. Questions used were not included. Findings were merely reported in terms of percentages, e.g. percentages of participants stating the new LMS better or worse than the previous. More to the point, in other studies comparing LMSs, subjects were facing a choice of using one LMS or the other, or had access to both, then appraised them. In the present study, the academic program was identical while participants were students in two consecutive academic years embodying two unrelated samples. Furthermore, the research described in this paper used a sound theoretical framework to study the perceived process of learning through the lens of SRL. In this research, program completion and academic achievement were studied as well.

2 Theory

2.1 Self- and Co-Regulation of Learning

For the purpose of comparing ways students carried out their learning, the framework of SRL was used. Panadero, in his 2017 review of SRL, stated that "Self-regulated learning is a broad field that provides an umbrella to understand variables that influence students' learning" [15]. Many models have attempted to conceptualize SRL and although they differ, the majority of them refer to three general phases of regulation through which learners proceed cyclically [17]. The phases refer to three time-frames during which regulation strategies are thought to be evoked or enacted. These are anticipation strategies occurring before the actual cognitive activity of studying the matter being aimed at; strategies occurring during the actual cognitive activity of studying; and, appraisal or assessment strategies occurring after developing the coveted knowledge. The model

used for this research [7], includes a fourth decision-making phase. Decisions are the indication of the use of deliberate regulation strategies; ones that are chosen consciously. The individual and collective regulation of learning scale (*Échelle de Régulation Individuelle et Collective de l'Apprentissage*, or ERICA) [13] was developed in conformity with this model. The scale enables studying six macro-level [5] SRL strategies learners believe to use. The strategies are mapped to the theoretical cyclical process which comprises anticipation strategies, control and monitoring during the actual cognitive pursuit of the targeted knowledge, assessment strategies that follow, and decision-making that ends a regulation of learning cycle and which may lead to the start of a new cycle. Two macro-level strategies measured with ERICA are mapped to the anticipation phase, they are Individual Anticipation of materials and References (IAR) and Individual Environmental Control (IEC). One measured strategy is mapped to monitoring of the learning process – Individual Tracking and Monitoring (ITM). Two strategies are mapped to the assessment phase. These strategies are Collective Evaluation of Content (CEC) and Individual Evaluation of Method (IEM). One strategy measured with the scale is mapped to decision-making – Collective Decisions for Method change (CDM). Table 1 summarizes the phases and measured strategies.

The scale has been used to study similarities and differences in perceived use of self- and co-regulation strategies in learning environments comprised predominantly of digital interfaces [10,12,9]. Several studies have also been carried out with students in face-to-face learning settings [14,10].

In hypermedia environments, successful self-regulated learners use strategies to enhance the effectiveness of their learning [2]. It has been suggested that these individual, reciprocal and collective strategies [11] are brought into play according to the perceived affordance of the environment [19]. Digital environments can be designed in ways to scaffold the use of strategies [3,8]. Environments may also be perceived by users as not offering such support or even as constraining. In such cases, individuals and groups may resort to regulating their learning using other means, perhaps using other online digital services for example. The question of whether a change in the digital environment around which the learning is organized would modify the strategies perceived to be used by learners is one that this research sought to address.

2.2 Completion and Academic Achievement

Persevering in the face of difficulties has been addressed using the term persistence. For example, persistence of learners enrolled in Massive Open Online Courses (MOOCs) has been studied [6]. Persistence as an ongoing process can be studied using indicators at different points in time (see Evans, Baker & Dee [4] for an example). Contrary to MOOCs, on the digital campus FORSE, which is not designed around the concept of openness of access to the masses, completion as a general indicator for persistence was studied for the two academic years 2017–18 and 2018–19.

For academic achievement Grade Point Average (GPA) scores were used as an indicator.

Table 1. Phases and Learning Regulation Strategies Measured with ERICA [13]

Phase	Code	Regulation Strategy	Item Example
Anticipation			
	IAR	Individual Anticipation of materials and References	At the beginning of a course I look into various documents to know what it is that needs to be learned in order to succeed in the course.
	IEC	Individual Environmental Control	I set myself up in a place where I will not be distracted when I am learning.
Monitoring			
	ITM	Individual Tracking and Monitoring	I keep track of my learning activities in a logbook or a journal.
Assessment			
	CEC	Collective Evaluation of Content	I sometimes discuss the state of progress in my studies with other learners.
	IEM	Individual Evaluation of Method	I sometimes question my learning method.
Decisions			
	CDM	Collective Decisions for Method change	The learning methods I use are the result of a choice made with others in which I took part.

3 Method

Data was self-reported. Participants used an online version of the ERICA questionnaire. It was administered via a server using Drupal™ software and an installed Webform module. Students were asked to respond during the second semester of each academic year. Responses were recorded from January 20 to April 9, 2018, when Blackboard Learn was in use, and from January 19 to April 12, 2019, when Moodle was being used as the LMS.

Students were free to respond if so they wished. Confidentiality of provided data was guaranteed, ensuring data treatment would be automated using software. Reporting of the research results was guaranteed to not include participants' names. Compliance was ensured with the General Data Protection Regulation (GDPR) law of the European Union and with local regulations.

An extraction from the university's administration database containing GPAs for each entire year of enrolled students, provided information enabling to compute completion rates. Students who did not complete the year carried a code in

the database to designate this. This code was used to measure the rate of completion. The same data extracted from the university's administration database also provided GPA scores, enabling to compute rates of academic success. The grade point system is based on a 0–20 point score. A GPA of 10 and above confers the academic degree *Licence*, the French equivalent to a Bachelor's degree.

4 Results

Participants in this study were third-year undergraduates enrolled in the online digital campus FORSE at Lumière University (Lyon 2) between 2017 and 2019. In 2017–18, 418 students were enrolled in the program at that university. In 2018–19, 401 students were enrolled in the program at the same university.

All reported analyzes that follow were done using statistical software R, version 3.6.1 [18].

Students did not receive incentives to participate in the research. The percentage of ERICA respondents taken from the total number of students enrolled in 2017–18, was 36.36%. The percentage of respondents for the year 2018–19 was 34.16%. Respondents to the online ERICA questionnaire for the year 2017–18 were 131 female students and 19 male. Two respondents chose not to disclose their gender. Female students represent 86.18% while male students represent 12.50% of respondents for that year ($n = 152$). Respondents for the year 2018–19 were 122 female students and 15 male. Female students represent 89.05% while male students represent 10.95% of respondents for the second year being compared ($n = 137$). The proportion of women and of men is not statistically significantly different between the two years (Fisher exact probability, $p = .052$).

The median age of ERICA respondents for each of the compared years was respectively 34 and 32 years old. The difference in ages between participants of the two compared years was nonetheless not statistically significant, $t(287) = -1.70, p = .091$.

4.1 Self- and Co-Regulation of Learning

As a first step in comparing self-regulation perceived strategy use, descriptive statistics for each cohort of students were looked at, i.e. participants during 2017–18 when Blackboard was the LMS being used, and participants during 2018-19 when Moodle was the LMS in use. Table 2 provides results for descriptive statistics and for internal consistency measures for each regulation of learning strategy measured. Measures were consistent. Cronbach's alpha reliability measures (α) ranged between .79 and .90 for measures of strategies in both cohorts.

A comparison between cohorts of perceived use of self- and co-regulation strategy use, was carried out next. To this end, a multivariate analysis of variance was performed. No significant differences between the cohorts surfaced, $F(1, 246) = .77, p = .596$. Between-subject effects on each variable were also computed, with no evidence found of significant differences between cohorts for each regulation of learning macro-level strategy.

Table 2. Internal Consistency and Descriptive Statistics of Measured Regulation Strategies per Academic Year

	2017–18					2018–19				
Strategy	α	Min	Max	M	SD	α	Min	Max	M	SD
IAR	0.82	0.4	4.0	2.53	0.84	0.81	0.4	4.0	2.59	0.80
IEC	0.90	0.0	4.0	2.92	0.89	0.87	0.4	4.0	2.95	0.81
ITM	0.88	0.0	4.0	1.66	1.28	0.86	0.0	4.0	1.45	1.18
CEC	0.89	0.0	4.0	1.83	0.98	0.85	0.0	4.0	1.66	0.89
IEM	0.79	0.2	3.8	2.21	0.68	0.79	0.2	4.0	2.25	0.65
CDM	0.84	0.0	2.8	0.62	0.67	0.82	0.0	3.2	0.70	0.67

Note: Values for measured regulation strategies span from 0 to 4.

4.2 Completion and Academic Achievement

The number of students in the 2017–18 cohort that had followed their studies up until the end of the program, fulfilling all requirements and taking all examinations, was 281. These students, who persisted during the academic year represent 76.2% of enrollments in the graduate program. Drop-out rate was hence 32.8%. The number of students in the 2018–19 cohort that had followed their studies right up until the end of the program, fulfilling all requirements and taking all examinations, was 200. The number of these students is only half of that year's enrollments. Those who completed the academic year stand for 49.9%. Drop-out rate was therefore, 50.1% for that cohort. The drop in the number of students who persisted until the end of the program is statistically significant, $\chi^2(1, N = 819) = 25.42, p < .001$.

Academic achievement, gauged by the number of students who had graduated among those who completed the program, was 98.9% in 2017–18. Failure rate was hence 1.1% for the year during which Blackboard was still being used. Academic achievement in 2018–19, based on the same measure of the ratio between diploma receivers and the number of students fulfilling all requirements was 95.5%. Failure rate for the year Moodle replaced Blackboard as the digital campus' LMS, was 4.5%. The drop in the ratio of the number of graduates over the number of program-completing students was statistically significant (Fisher exact probability, $p = .033$).

Final GPA scores credited to students in 2017–18 ($M = 13.23, SD = 1.43$) were compared with scores students were credited the following year, in 2018–19 ($M = 12.72, SD = 1.59$). An F test for equal variances in unrelated samples was first used to check homogeneity of variance ($F = .81, p = .262$). As no imbalance between variances was found, a true t test was performed, $t(217) = -2.48, p = .014, d = .34$. Results indicate that grade means indeed differ between 2017–18 and 2018–19.

5 Analysis of Results and Discussion

Significant differences in self- and co-regulation perceived strategy use were not found between the 2017–18 and 2018–19 cohorts. Although demands for more control and flexibility in using and shaping the interface by academic personnel were partially granted, the initial effort was to reproduce an environment offering similar services. At the time that the new LMS was being launched, fundamental changes in text-based resources and the overall instructional design had not been modified. The attempt of the three involved institutions to reproduce a digital environment with a similar structure, comparable services and the same digital textbook-like resources, as well as the fact of wishing to maintain the core instructional design and educational staff, may have well led to similarly perceived strategy use by students. Self- and co-regulation strategies are deployed by learners in conjunction with their perceptions of the surrounding learning environment [19]. The attempt to reproduce a similar environment, both in terms of roles actors played and ways interactions took place with educational staff as well as the attempt to structure the digital environment similarly, may have had a notable effect on learners' perceptions of the way they conduct and manage their learning tasks and processes within these environments. The hypothesis that the relative enduring similarities between environments were linked to similarly perceived SRL strategy use needs to be substantiated. Reproducing the major characteristics of the environment had also enabled to preserve the instructional design. It is perhaps the latter which had a marked effect on perceptions that students had of their learning strategies. The consequence of having changed LMSs hence seems to have been negligible. As mentioned, some changes had nevertheless been introduced to the environment, though not to a point which would have modified the instructional design. Despite the generally preserved structure, several of the changes that had been made were seen by staff as enabling more control over the environment while other staff members saw the implementation of the new LMS as a setback.

In future studies in which digital environments are changed and their effects are studied, a comparison of self- and co-regulation perceived strategy use; for example, of the undergraduates with those pursuing the postgraduate program, may shed more light on this hypothesis. Within FORSE, the overall instructional design of the postgraduate program is different from that of the undergraduate program. If indeed no significant differences in strategies are to be found between consecutive years for undergraduate cohorts while independently no differences are to be found between postgraduate cohorts, this would reinforce the hypothesis that the instructional design is a prime factor affecting perceived strategy use. If it were to be found that from one academic year to the next, no significant differences are found while SRL strategies remain differentiated between each program strand, this would strengthen the assumption that reconstituting an environment in its broader sense is of greater importance when considering a change in LMS software.

Completion rates have nonetheless significantly dropped. Two-thirds of students persisted until the end of the academic year 2017–18, handed in all as-

signments and attended examinations. During the following year, after the new LMS was put to service, only half the students persisted. Dropout rates during the third year graduate studies have varied in the past, though comparisons with data from this study are difficult to make as a result of some changes in the graduate program that took place before the study began. Previous to the two studied years in this paper, up until 2016–17, students could opt from the start to complete the third-year graduation studies over a period of two years. Those students who did opt to study over a period of two years in 2016–17 were still following their studies through in 2017–18. This may explain the higher completion rate of students at the end of 2017–18.

A slight drop in academic achievement was also noted, from 98.9% to 95.5%. Finally, GPA scores dropped too, from 13.23 to 12.72 points (out of 20). Both drops, in academic achievement as well as in GPA scores, were statistically significant. Many factors could have contributed to the plummeting, in particular of student persistence. Analyzing data from years to come, should enable to establish if these changes were momentary or lasting. It should enable to narrow down the number of possible factors that may have contributed to changes by determining if the findings of this study were due to an exceptional event that led to the abrupt changes in completion and to lower grades plus the slight drop in academic achievement; or rather, the manifestation of a phenomenon related to other factors than the swapping of LMSs. Future analyzes should enable inspecting factors, eliminating some unlikely to have played a role and to formulate hypotheses that could be put to test in future studies.

6 Conclusion

The hypothesis that the stability in perceptions of self- and co-regulation strategies used by students is due to the constancy in the program design, learning materials and services as well as the overall instructional design, is plausible but will require further studies. As to the drop in completion rates, a finer grained study of factors that underlie it will no doubt be required. With future data collected at the end of following academic years, patterns, if any emerge, will enable to discern what fluctuations in completion may be due to. By better understanding factors contributing to fluctuations, improvements can be made to counter any adverse effects and enhance any contributing features to the persistence of students in the programs offered via FORSE as well as perhaps provide insight regarding means to favor completion in other digital educational environments. As to GPA scores and academic success, although significant drops were found, they were slight and may be due to variations in the composition of cohorts and their dynamics. Other factors may also play a role in grade attribution by tutors and instructors. Again, comparisons with results from years to come will be valuable to examine.

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