Variations in Self-Regulation of Learning On-line Versus On-Campus

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Abstract. This paper describes the results of a study that compared self- and co-regulation perceived strategy use of Master's in Education students learning in two distinct learning environments. One cohort of students was studying predominantly face-to-face on-campus while the other studied predominantly on-line. Comparing the two cohorts enabled to contrast perceived regulation of learning strategy use. Subjects were postgraduate students in Educational Sciences studying in a French university during the academic year 2017–18. Data was collected using ER-ICA [12] which is a scale intended for measurement of six macro-level strategies of regulation of learning. The study found that two strategies differed in perceived frequency of use by students. The strategies were Individual Anticipation of materials and References (IAR) and Individual Tracking and Monitoring (ITM). Environmental conditions, instructional cues and group characteristics are discussed as potential explanations for the found similarities and differences. Future research directions are suggested to further explore the interplay between the ways students learn and environmental characteristics.

Keywords: Self-regulation · Co-regulation · Self-regulated learning · e-Learning · Anticipation · Monitoring · Learning environment

1 Context

The field of Self-Regulated Learning (SRL) has gained momentum since Zimmerman and Martinez Pons [23] explored how learners regulated their learning in the mid nineteen eighties. Researchers have taken interest in regulation of motivation, some have focused on regulation of cognition or on both, while others have also explored regulation of affect. Regulation of cognition or cognitive

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regulation, has been explored both as trait and as event, i.e. as a disposition to self-regulate as well as by observing the fine-grain details of how individual learners self-regulate as they work toward a specific learning goal. Some measurement instruments are suitable to measure the former "aptitude measures" while others are more suitable as "event measures" [22,1]. ERICA, a scale designed to measure self- and co-regulation of learning [12] is suitable for aptitude measures. The strategies to regulate learning that can be measured with ERICA are deployed by learners before, during and after the cognitive activity aimed at gaining specific knowledge, though the strategies together are part of the learning process. Two sub-scales measure strategies that are classified as occurring before the aforementioned cognitive activity. They take place during the Anticipation phase. One strategy is classified as taking place during the cognitive action, named Monitoring. The phase taking place after the cognitive action is named Assessment. Two types of strategies are measured with ERICA pertaining to this phase. One is a strategy which is individually carried out; the other, a strategy that is carried out with other learners. A fourth phase was introduced in the theoretical model of regulation of learning phases [6,7]. This phase, which is labeled Decisions, is measured with ERICA in its collective form. Decisions that are measured pertain to a change in methods used by learners to develop their knowledge. Strategies measured with sub-scales in ERICA should be considered as macro-level strategies. Learners deploy a vast number of micro-level strategies that are specific to not only the learner but also to the study field, motivation, goal orientation [16], situation, including environmental conditions, and social context. These micro-level strategies can be observed with event measures. ERICA is an instrument intended as a trait measure. It enables to depict a general picture of regulation strategies of a population of learners.

Research using ERICA is an ongoing exploration in an attempt to identify tendencies or patterns of regulation characteristic of learners in different environments. Comparisons of regulation that emerge in different environments need to also take into account other variables such as those related to demographic trends, topics being studied, instructional designs, support materials and teacher cues. In parallel to the exploration of relations between contextual variables, situational ones, population attributes and regulation strategies, the research program has begun testing the substantive validity of the theoretical Regulation of Learning Phases Model [10,9]. Digitally based environments for learning are of particular interest as they enable educational staff to easily modify appearance through software choice, software parameters, configurations, graphic design, choice of software modules and their arrangement, interfacing with other software, services, tools, etc. The ways some of these choices could modify, hinder or support self- and co-regulation of learning should be of interest to educators as well as other stakeholders committed to promoting successful learning.

Environments can enable learners to use different kinds of learning strategies. Not giving the means for enacting certain strategies may lead to adaptations in the ways learners regulate the learning process. For example, a case of not using a strategy because it is not braced by the design of an e-learning environment

may lead to the use of another means or strategy to increase the effectiveness of the learning; or, it could adversely prevent the learner from enacting a regulation strategy that would have otherwise improved learning. Strategies may manifest themselves in some environments either because they can possibly be deployed in them and students choose to, perhaps also because learners are encouraged to; or, because they are used as compensation for the impossibility or the inadequacy to use other, perhaps preferred, strategies that the learners are accustomed to use. The complexity of the interplay between environmental conditions and individual variability in strategy use does not lend itself to attempt generalization from studies of the processes as events. On the other hand, a general understanding of the interplay between the environment and strategy use for effective learning can be attempted by studying learners' perceptions. Through repeated measurements in different environments and varying situations, researchers can compare learners' regulation strategies in relation to the way learners engage and use the resources available to conduct and manage the learning process. Researchers can then study similarities and differences while taking into account contextual variables to learn about environments that are supportive of effective learning, student well-being and outcomes. The fields of cognitive ergonomics and the study of affordance, as the perceived possibility for action in a given e-learning environment [4], is the backdrop for the study presented in this paper.

2   Theory

Self-regulated learning has been the focus of researches for four decades with the more recent incursion into co-regulation becoming the focus of some authors during the last decade [11,10]. Co-regulation in learning refers to strategies used by learners that involve interaction with peers. Interactions can take place both face-to-face and through the use of mediating technologies. The most common of these mediating technologies are general use text-based applications such as messaging and e-mail as well as specific services such as forums which are integrated in Learning Management Systems (LMSs). Exchanges can also take place using audio (phone calls or vocal messages) and through the use of audio-visual software or services (video calls, video-conferencing, video-recordings) that are sometimes integrated in or linked to LMSs.

ERICA can be used to determine perceived frequencies of strategy use. The scale measures six macro-level self-regulation strategies among which two are categorized as co-regulation strategies. The measured strategies are mapped to the theoretical model of regulation of learning phases [12] (refer to Table 1).

The study presented in this paper compared regulation strategies of graduate students learning in a distance education program on-line with graduate students learning on-campus. Students in the two cohorts were not enrolled in the same program, although both were preparing a Master's degree in educational sciences. The on-line cohort was made up of two groups taking a statistics course during their first-year of post-graduate studies while students on campus were made up

Table 1. Phases and Learning Regulation Strategies Measured with ERICA [12]

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 learning is required to succeed in my education.
	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 discuss the state of progress in my studies with other learners.
	IEM	Individual Evaluation of Method	I wonder about 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.

of two groups taking a course in digital humanities on approaches in psychology and ergonomics applied to digital learning. The latter courses were provided to second-year post-graduate students in educational sciences.

Several previous studies using ERICA had explored various facets of Self- and Co-Regulation (SCoR). Laurent and colleagues [13] studied links between SCoR and executive functions. Simonian and colleagues studied links between affordance and SCoR of e-learning students [20] and studies of links between SCoR and interpersonal relationships of online students [8] as well as the study of a model of self-evaluation of the learning process [10] had been carried out. However, no known study using ERICA has yet compared regulation strategies used by on-line learners with those used by on-campus students. The research presented here sought to compare precisely that i.e. similarities and differences in regulation of learning strategies within these two educational formats.

3 Method

Data was self-reported. On-line students used an online version of the ERICA questionnaire. It was administered via a server using Drupal^{TM} software and an installed Webform module. Students were asked to respond over a period of one week at the end of their courses which took place during the second semester of the 2017–18 academic year (February 5–11, 2018). On-campus students responded during a class session (first week of December 2017) using a printed

version of the questionnaire. All student were free to provide their responses if so they wished. Both online and paper-based responses were provided anonymously.

The LMS used with the on-line students was BlackBoard Learn^{TM}. Online students were respondents from two groups, each studying with a separate instructor. Students who had chosen to major in social work and health-care education plus those majoring in adult education were in group A with one instructor. Students who had chosen to major in the formal education professions were in group B with another instructor. On-campus respondents were students from two groups too. One was a group made up of students in a regular program while those in the other were students in a shortened program. Both groups were preparing the same Master's degree in adult education. The shortened program was catered to adult learners who were health-care instructors working in higher-education institutions providing health-care and nursing qualification training. On-line group A and both on-campus groups had the same instructor. On-line group B had a separate instructor.

Instruction in all groups combined classroom sessions with independent small-group tasks to be carried out by students. Cues given to students in online group A and and on-campus courses followed cooperative learning guidelines [5].

For comparisons to be made in order to consider similarities and differences in regulation strategies, data was described then analyzed. To begin, a multivariate analysis of variance (MANOVA) was performed to determine if similarity in variances between perceived strategy frequency use of learners in the two on-line groups was such as to consider collating the date to form the on-line cohort. Likewise, similarity in variances between the two on-campus groups was sought. To the degree to which the mean differences within each learning realm would be statistically insignificant, comparisons of variances between the on-line and the on-campus learners' data were to be sought. A detailed description of this process and the resulting findings follow.

4 Results

Analyzes were performed using R, version 3.5.2 [17]. A MANOVA was performed on each set of the two groups. The first set of groups was made up of the on-line students ($n = 70$). The second set of groups was made up of the on-campus students ($n = 35$). Results for the set of the on-line groups were previously computed [10]. Analyzes were run again for the purpose of this study with identical results [$F(1,55) = 1.22; p = .310$]. Results for the set of the on-campus groups indicated no significant differences in perceived regulation frequencies either [$F(1,33) = .91; p = .504$]. Between-subject effects on each variable were also tested with no significant differences between groups within each set.

Once consistency and homogeneity of data from each environment – on-campus and on-line – was established, descriptive statistics were calculated and internal consistency analyzes of the measures were carried out to estimate reliability for each cohort. Results were satisfactory for all dimensions represent-

Table 2. Internal Consistency and Descriptive Statistics of Measured Regulation Strategies
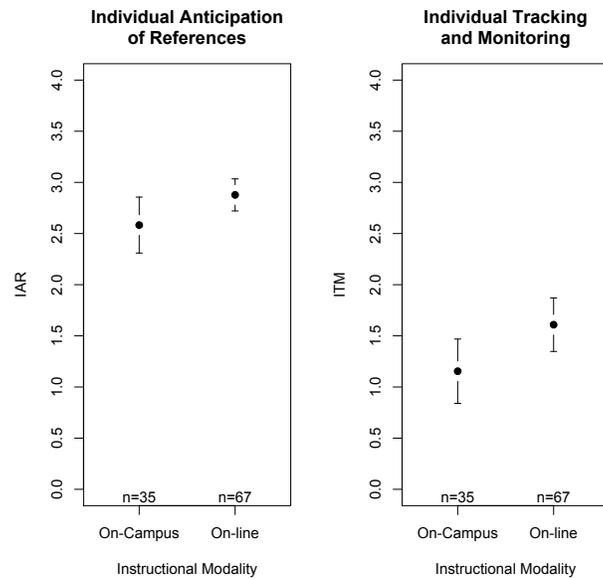
Strategy	On-Campus					On-line				
	α	Min	Max	M	SD	α	Min	Max	M	SD
IAR	0.77	0.8	4.0	2.58	0.80	0.77	1.2	4.0	2.88	0.64
IEC	0.90	0.6	4.0	2.81	0.97	0.84	1.0	4.0	2.94	0.75
ITM	0.74	0.0	3.2	1.15	0.92	0.81	0.0	4.0	1.61	1.00
CEC	0.88	0.8	4.0	2.35	0.81	0.78	0.6	3.4	2.12	0.72
IEM	0.82	1.0	3.6	2.29	0.65	0.73	1.0	3.2	2.18	0.56
CDM	0.85	0.0	3.4	1.35	0.85	0.86	0.0	3.0	1.19	0.82

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

ing macro-level strategy frequency of use (see Table 2). Analysis of similarities and differences in perceived frequency of use of regulation strategies between the on-line and the on-campus cohorts was carried out next. First, a MANOVA was carried out. It did not reveal a significant difference $[F(1, 90) = 2.03; p = .070]$, however between-subject effects on each variable did uncover differences between on-campus and on-line perceived frequency of use for two macro-level strategies. The strategies for which differences were found were Individual Anticipation of materials and References (IAR) and Individual Tracking and Monitoring (ITM). An F test for equal variance in unrelated samples was first used to check homogeneity of variance for IAR ($F = 0.65, p = .138$) and for ITM ($F = 1.37, p = .316$). Following, a true t-test was performed to compare the means of scores for these strategies from on-campus and on-line subjects. IAR scores were statistically significantly higher for on-line students ($M = 2.88, SD = 0.64$) than for on-campus students ($M = 2.58, SD = 0.80$), $t(100) = 2.02, p = .046, d = .42$. ITM scores were statistically significantly higher too for on-line students ($M = 1.61, SD = 1.00$) than for on-campus students ($M = 1.15, SD = 0.92$), $t(100) = 2.13, p = .035, d = .45$. Figure 1 illustrates these differences.

5 Discussion

Comparing perceptions of degrees to which regulation of learning strategies were used in terms of their frequencies, requires taking contextual and situational variables into account. The research method and measurement instruments that were used are not intended for fine-grained observation of individual processes; they are intended to detect general dispositional tendencies across groups. Past personal sociohistorical experiences of respondents were hence not accounted for. On the one hand social environmental conditions that served as the backdrop of the study needed to be accounted for as they inform on the conditions that surrounded the learners. These conditions could have been constraining or

**Individual Anticipation
of References**

**Individual Tracking
and Monitoring**

Fig. 1. Means with Confidence Intervals of IAR and ITM Strategies On-Campus and
On-line

enabling to varying degrees. They form the circumstances or situational variables that may have played a role in the way students perceived their ability to successfully conduct their assigned learning tasks. On the other hand, regulation strategies that were measured as similar among the studied cohorts can be considered as invariable within the academic environment of studies in the specific academic field, time, culture and place they took place in. Differences in measured regulation between cohorts could be the result of varying situational characteristics, such as the course topic, instructional design, learning materials and instructional cues that were given.

Given the similar results for four out of the six strategies, one can assume these results were due to shared contextual elements among the two cohorts. Differences found between the cohorts for the remaining two strategies can perhaps be attributed to perceptions students had of other environmental features, in particular those pertaining to perceptions of instructor proximity.

Measurements that did not reveal significant differences in their perceived frequency of use were Individual Environmental Control (IEC), Collective Evaluation of Content (CEC), Individual Evaluation of Method (IEM) and Collective Decisions for Method change (CDM). Two of the six strategies were significantly different, these were Individual Anticipation of materials and References (IAR) and Individual Tracking and Monitoring (ITM). Both these strategies were perceived to be used more frequently by students studying on-line. Both

these strategies were carried out individually and are considered crucial to effectively self-regulate learning. The importance of monitoring was demonstrated in Greene and Azevedo's [3] study while anticipation strategies were previously demonstrated to be associated with higher grades [8].

The question that needed to be addressed was: what differences existed between on campus groups and on-line groups that could have contributed to differentiated perceptions? Data for control variables were not gathered from on campus students. These would be valuable for comparisons. Nevertheless, in line with the design of the research, it is reasonable to regard differences in regulation strategies as also attributable to differences in students' instructional environments.

In previous research [8] IAR scores were higher when students were assumed, based on age, to be more experienced. The on-line students in education sciences attending the university were perhaps more experienced which would explain the higher scores. This will need to be corroborated in future studies. It is hypothesized that more experienced students both as learners and generally, have developed more systematic use of anticipation strategies. It has been demonstrated that high prior knowledge students were more prone to engage in planning and monitoring [15]. Constraints on older students such as managing work-related contingencies and family contingencies may be higher. These older adults are presumably those who chose to study on-line as on-line modes offer more flexibility to accommodate work and family constraints.

Individual Tracking and Monitoring (ITM) is key to effectively regulate learning [21,8] in particular when complex topics are being studied [3]. The assumption is that the absence of face-to-face guidance transfers the perceived responsibility for regulating learning to the learner. The learner may feel a heightened demand to self-regulate as the transactional distance [14] grows. To self-regulate effectively the learner needs to refer to past learning episodes that may be somewhat segmented when learning on-line. In absence of tracking and monitoring, segmentation and episodic learning for perhaps relatively short spurts of cognitive activity directed at the learning topic and perhaps spaced episodes of longer duration, make tracking more arduous, thus necessitating greater attention to tracking and more frequent monitoring.

To the question were challenges different for learners in each environment, the answer is without doubt that they were. For one, the transactional distance for learners was different and so the perceived relative presence of the instructors may have challenged learners differently. An earlier study had uncovered that the way learners perceived the Reference Person to the Field of Study (RPFS) affected co-regulation strategies [6]. The amplitude of anticipation of group processing was significantly higher and the assessment process of co-evaluation was more frequent when no RPFS was assigned to the group of learners in that study. In the present study, the frequency of perceived use of the IAR strategy may have similarly been affected, as students had probably perceived themselves to be primarily in charge of organizing and managing their learning. Tracking and monitoring was perhaps also perceived to be under the helm of the students.

These assumptions would need further studying as indeed it would be possible to study RPFS perceptions of students in conjunction with self- and co-regulation.

6   Conclusion

In this study perceived frequency of use of SCoR strategies of first-year graduate students learning in a distance education program on-line in two groups were compared with SCoR strategies of second-year graduate students learning on-campus in two other groups. Each pair of groups formed a cohort, the former of on-line students, the latter of on-campus students. Students in the two cohorts were not enrolled in the same program though both were enrolled at the same university in the same institute and shared some of the teaching staff. A series of MANOVAs confirmed that the pairs of groups did not present statistically significant mean differences in measured SCoR strategy use within each cohort. Cohorts did however present differences in perception between on-line and on-campus students for two self-regulation strategies. Significant differences were found for Individual Anticipation of materials and References (IAR) and for Individual Tracking and Monitoring (ITM). Both these strategies were statistically significantly higher for on-line learners.

To explain the differences that were found, transactional distance theory [14] and self-determination theory can prove useful [2,19]. The transactional distance is assumed to be perceived by the students as greater in the on-line learning environment [14], though this would merit checking in future studies. The greater transactional distance requires students to be more autonomous while at the same time contributing to a stronger feeling of autonomy [18]. If learners feel able to accomplish the learning task in an environment perceived as generating increased learner to instructor distance, this would lead to fuller engagement in the task, effectively self-regulating learning and a keen pursuit of the learning activities.

Students who had perceived that responsibility was more theirs for successful learning outcomes, may have led to stronger proactive engagement in the learning process, in particular regarding tracking and monitoring progress. Both strategies for regulating learning that were perceived to be higher by on-line learners were carried out individually (IAR and ITM). Co-regulation strategies were not perceived to be statistically different, nor was Individual Environmental Control (IEM). The co-regulation strategies Collective Evaluation of Content (CEC) and Collective Decisions for Method change (CDM) were not perceived differently by the two cohorts, perhaps as in both environments the learning tasks were organized similarly, based on small group team learning with a collective task to be carried out and a group report to be completed.

Repeated measures with other on-line and on-campus cohorts should enable to ascertain that differences found in IAR and ITM perceived strategy use do indeed follow a similar pattern. If indeed IAR and ITM are more frequently reported in on-line environments, measuring perceptions of the RPFS as a surrogate for transactional distance as well as perceptions of autonomy would enable

to test the relation between the perceived transactional distance, autonomy as a mediator and the frequency of use of self-regulation strategies.

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