Cognitive Engagement's Effect on Digital and Distance Learning Outcomes in Higher Education

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ABSTRACT

BACKGROUND: The current contexts of collaborative learning and self-learning, inserted in technological environments designed for Digital Learning, allow the achievement of different performances both at the cognitive and operational levels (Ramirez-Arellano et al., 2018).

AIM: To identify cognitive engagement strategies and solutions and to verify the existence of a correlation between these strategies and learning outcomes, in the context of higher education.

METHODOLOGY: This dissertation used the survey methodology. For the experiment, distance learning students were asked to answer a questionnaire and teachers and coordinators were asked to answer a different questionnaire.

RESULTS / FINDINGS: The results from the questionnaires are presented. Correlations between learning strategies and learning outcomes are analyzed. Students' opinion on distance learning and overall engagement in the MISE are also presented. A correlation and association analysis was made between certain questions that were deemed more important to meet the goals of the students' questionnaire.

CONCLUSION: The reasoning behind the research methodology is presented and explained. Conclusions from the state of the art, literature review and results from the questionnaires are taken, in line with the research problem, questions and objectives. Limitations and future work are discussed.

ORIGINALITY / VALUE: Few studies directly analyze the relationship between students' cognitive engagement and learning outcomes, especially in higher education (Gunuc, 2014).

KEYWORDS

Higher Education; Cognitive Engagement; Learning Outcomes; Digital Learning

1 Introduction

There is a need for the education sector to adapt to an ever-changing digital environment and to keep up with an aggressively dynamic world (Anthonysamy et al., 2020). Students can become more autonomous, taking charge of their learning, which opens the window to innovative intervention that cognitively engages students (Malecela & Hassan, 2019). However, contemporary researches reveal that students have trouble with digital learning, due to their lack of self-regulation skills, resulting in mediocre performance (Anthonysamy et al., 2020; Anthonysamy et al., 2021).

Cognitive engagement of students is a very prominent phenomenon in current learning strategies that quicken the acquisition of necessary skills in the job market (Robles, 2012, as cited in Malecela & Hassan, 2019; Lee et al., 2018). Cognitively engaged students are more capable of generating new knowledge and have greater understanding of what is being discussed in online forums (Malecela & Hassan, 2019; Shukor et al., 2014). This highlights the importance of this type of engagement and self-regulation strategies in learning (Joo et al., 2014), especially in types of digital learning where there is less guidance from the teacher (Joo et al., 2014).

The current contexts of collaborative learning and self-learning, inserted in technological environments designed for digital learning, allow the achievement of different performances both at the cognitive and operational levels (Ramirez-Arellano et al., 2018). This article has as its main objectives, the identification of cognitive engagement strategies and solutions and to verify the existence of a correlation between these strategies and learning outcomes, in the context of higher education. In this context, the following research questions were identified:
1) What are the main cognitive engagement strategies for higher education contexts?
2) What technological environments are available for applying cognitive engagement solutions?
3) What correlation exists between the proposed strategies and learning outcomes, in digital learning environments?

2 State of the Art

2.1 Digital Learning

Digital learning is a very broad subject that encompasses many sub-types of learning, but it can be defined as any style of learning that effectively utilizes technology to provide knowledge to their students (Anthonysamy et al., 2020). Digital learning is based on accessibility and use of content (Shalev-Shwartz, 2011).

Big advantages of digital learning are flexibility, ease of learning customization, faster training and more control over the learning process (Anthonysamy et al., 2020; Anthonysamy et al., 2021; Choudhury and Pattnaik, 2020). Some disadvantages include students' skepticism and distaste of distance learning and blurred barrier between work and home/family life.

Anthonysamy et al. (2020) conclude in their research that the acquisition of cognitive skills is needed to achieve deeper learning in digital learning. As more higher education institutions assimilate new technologies into their learning environments to improve their students' learning, it becomes progressively more important to have a propound grasp of their results on student's learning outcomes (Blasco-Arcas et al., 2013).

2.2 Cognitive Engagement

Rotgans and Schmidt (2011) define cognitive engagement as the length to which learners are willing and capable of tackling the learning assignment at hand, including how long they will persist (Richardson & Newby, 2006; Walker et al., 2006, as cited in Rotgans & Schmidt, 2011). Cognitive engagement is put to use by integrating and using students' motivations and strategies in their learning (Richardson & Newby, 2006). Cognitive engagement focuses on students' psychological investment in academic tasks, the mental process of gaining knowledge and self-regulation strategies students use in their learning (Lei et al., 2018) to understand and master knowledge and skills (Xu et al., 2020).

Cognitive engagement strategies consist of four groups (Anthonysamy et al., 2020):

- Rehearsal – Practicing. Best in simple activities and using memory, instead of the acquisition of new information;
- Elaboration – Capability to link previous knowledge with new information, so as to remember new content;
- Organization – Capability of a student to choose the adequate information and manage their thoughts during the learning process;
- Critical Thinking – Ability to make contents more relevant by summarizing and evaluating them.

Anthonysamy et al. (2020) state that utilizing cognitive strategies promotes better student engagement online and in different educational environments (Shaw et al., 2019). Anthonysamy et al. (2021) found that students who employed these strategies had improved their learning outcomes. It is important to note, though, that different cognitive strategies will create different learning outcomes in different settings (Sedaghat et al., 2011).

2.3 Cognitive Engagement in Technological Environments

Cognitive engagement is essential in any learning environment (Malecela & Hassan, 2019). It has a massive role in the learning progression of students (Anthonysamy et al., 2020).

Shukor et al. (2014) found in their study that, for students' online cognitive engagement, sharing information and posting high-level messages are two significant variables. However, without proper design and facilitation, students might not engage in productive discussions, which will trouble their learning of the course material and their critical thinking skills development (Dennen & Wieland, 2007, as cited in Oh & Kim, 2016). Macfadyen and Dawson (2010) discovered that the online learning variables capable of predicting students' better future performance in tests, using a predictive model, are the amount of discussion messages posted, finished assessments and mail messages sent (as cited in Shukor et al., 2014).

There are four types of interactions in online courses (Abrami et al., 2011; Angelino et al., 2007; Chen, 2007, as cited in Chakraborty & Muyia Nafukho, 2014):

- Student – Student interactions;
- Student – Faculty interactions;
- Student – Technology interactions;
- Student – Content interactions.

These interactions are vital in determining engagement in online courses and to engage students (Chakraborty & Muyia Nafukho, 2014; Joo et al., 2014). Cognitive engagement and interactions in online discussions are key to the creation of new knowledge (Zhu, 2006).

Boling et al. (2012) uncovered that text-based learning and disconnections in class are barriers to engaging online classes (as cited in Chakraborty & Muyia Nafukho, 2014). On the opposite side, real-world-related and practical projects and social interaction foster the creation of effective online classes (Chakraborty & Muyia Nafukho, 2014).

3 Literature Review

Gunuc (2014) and Sedaghat et al. (2011) found in his study that there was a powerful, positive connection between cognitive engagement (and its strategies) and learning outcomes. When students' experience deep cognitive engagement, they become more inclined to use meaningful strategies, that they develop through the learning process, in the future (Schunk, 1991, as cited in Joo et al., 2014).

Galikyan and Admiraal's (2019) research into engagement in asynchronous discussions online detected a statistically significant

relationship between cognitive engagement and the final mark of the course. In agreement with current literature, the results indicate that online discussion forums have can help maintain the momentum of a conversation and broadening its focus, which will stimulate reflection outside the classroom (Galikyan & Admiraal, 2019). Galikyan and Admiraal (2019) conclude that online asynchronous discussion boards can be a useful tool to analyze students' cognitive engagement with the learning process.

The teacher's presence in an online discussion was uncovered to be another possible determinant that can influence types of interaction and cognitive engagement levels (Zhu, 2006). When a teacher is absent from a discussion or marginally participates, the messages tend to be informative and explanatory, however, if the teacher very actively participates, they may repress the dialogue (Zhu, 2006).

Joo et al. (2014) found that continuous course design modifications positively affected students' cognitive engagement and learning outcomes in open and distance higher education environments.

Students tend to be the most engaged during the evaluation periods of the learning process, this introduces an opportunity for teachers and higher education institutions to improve learning outcomes (Shaw et al., 2019). Online cognitive assessment tools usually mix many cognitive strategies within an evaluation, with the aim of improving learning (Shaw et al., 2019). However, becoming proficient with these online tools and platforms can be hard and time-consuming (Shaw et al., 2019). Online cognitive assessment tools can be useful, due to their flexibility (Shaw et al., 2019).

As it pertains to the flipped classroom model, it has been shown to have the ability to improve teaching practices and students' cognitive learning outcomes and motivation (Kostaris et al., 2017; Wu et al., 2020). It can also enhance the exploitation of face-to-face classes and provide more engaging learning experiences (Kostaris et al., 2017). Advantages attributed to flipped classroom learning include enhancing cognitive learning outcomes and motivation (Kostaris et al., 2017). Kostaris et al. (2017) found that the flipped classroom model had two main advantages, being that the students were much more engaged throughout the course and the worst students had the most learning improvement.

Previous studies (e.g., Kauffman, Ge, Xie, & Chen, 2008) suggest that students are able to self-regulate, but tend to fail to do it. Literature shows that a main predictor of learning outcomes is the ability to manage their learning progression (as cited in Anthonysamy et al., 2020). Self-regulated learning can be defined as an active process where students master their learning process (Anthonysamy et al., 2020). Self-regulated learning strategies can help students learn more efficiently (Anthonysamy et al., 2020). Many scholars have stated that, if one is to excel and be more efficient and effective in digital learning, one has to learn self-regulation skills (Anthonysamy et al., 2020). In addition, past studies have revealed that, without a doubt, students performed better online when using self-regulated learning strategies (Anthonysamy et al., 2020). Previous studies have also stated that self-regulated learning strategies lead to higher student engagement (Pellas, 2014, as cited in Anthonysamy et al., 2020). Haron, Harun, Ali, Salim, & Hussain (2015) find self-regulated learning to be a major predictor to learning outcomes (as cited in Anthonysamy et al., 2020). Self-regulation is a vital skill in very autonomous learning environments (Anthonysamy et al., 2020).

4 Methodology

This dissertation used the survey methodology, which is used to answer questions, solve problems, assess needs and set goals, to determine whether or not specific objectives have been met, to establish baselines against which future comparisons can be made, to analyze trends, and generally, to describe what exists, in what amount, and in what context. (Isaac & Michael, 1997, as cited in Glasow, 2005).

According to Kraemer (1991), survey research is used to describe specific aspects of a population quantitatively, which involves studying the relationships between variables. To analyze the population, a sample is selected from which the findings can later be generalized to said population (as cited in Glasow, 2005). Surveys can acquire data from large population samples and are particularly suited to gathering demographic data. Surveys don't need big investments to be created and carried out (Glasow, 2005).

However, surveys only supply estimates, not exact measurements (Glasow, 2005). Also, surveys are generally unsuitable when an understanding of the historical context is needed. Surveys are also subject to biases, from lack of response to the nature and accuracy of the answers received (Bell 1996, as cited in Glasow, 2005). Respondents might also find it difficult to evaluate their behavior or recall circumstances wrongly.

Designing a survey involves two steps (Levy and Lemeshow, 1999, as cited in Glasow, 2005):

1) Develop Sampling Plan;
2) Create procedures to get population estimates from the data and to appraise the reliability of said estimates.

The sampling plan explains the method used to select the sample, how the appropriate sample size will be determined, and the reasoning behind the choice of the media used to publish the survey (Glasow, 2005). The second step includes identifying the wanted response rate and level of accuracy for the survey (Salant & Dillman, 1994, as cited in Glasow, 2005).

The choosing of the sample depends on size of the population, homogeneity, the media and its usage cost, and the necessary precision level (Salant & Dillman, 1994, as cited in Glasow, 2005). Salant and Dillman (1994) observed that a prerequisite to sample selection is to define the target population as narrowly as possible (as cited in Glasow, 2005).

Determining the size of the sample depends on five factors (Glasow, 2005):

- Desired degree of precision (significance level or confidence interval);
- Statistical power required;
- Ability to gain access to the study subjects;
- Degree to which the population can be layered (according to sector, technology level, etc…);
- Selection of the relevant units of analysis (whether the respondents to a survey will be 2-3 individuals, offices, entire firms, etc…)

Salant and Dillman (1994) stated that the researcher must guarantee that the amount of distributed surveys is enough to permit non-responses and unusable ones (as cited in Glasow, 2005).

According to the methodology and process previously presented, the data of this investigation was acquired through the state of the art and the literature review (reading of the articles, reports, papers, books and so on…), for the first two research questions (Zawacki-Richter et al., 2020).

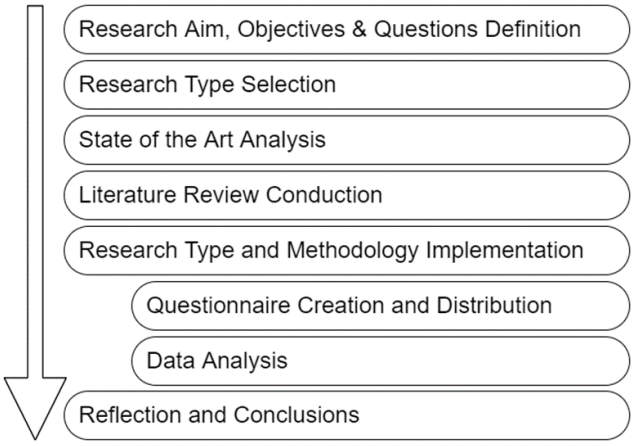

Figure 1: Research Methodology Diagram

Then, the primary data was collected through two questionnaires. The questionnaires will be carried out in accordance with the principles of the book "Manuel de recherche en science sociales (Portuguese Edition)" by Raymond Quivy and Luc Van Campenhoudt (2008). A questionnaire survey in social sciences aims to verify theoretical hypotheses and analyze suggested correlations (Quivy & Campenhoudt, 2008).

The first questionnaire's target demographic is students of a distance learning online masters. This questionnaire aimed to identify a correlation between the learning strategies distance learning students use and their learning results, learn their opinion on distance/online learning and compare their perceived effort with their performance and knowledge gained.

As for the second questionnaire, its target demographic is professors and coordinators of the same distance learning online masters. This questionnaire aimed to understand how the master's distance learning model affects student engagement.

Both questionnaires followed these methodological steps:

1) Reading the Research Problem, Questions and Objectives;
2) Reading the State of the Art and the Literature Review;
3) Coding of Information into Topics, so as to facilitate analysis;
4) Creation of Questions based on the Topics;
5) Review;
6) Addition/Removal of Questions (if necessary);
7) Review (if necessary);
8) Placement of Questions in their appropriate Section and Order;
9) Description of Sections to inform the participants on them;
10) Final Review of the Questionnaire;
11) Delivery of the Questionnaire to the Participants.

5 Results and Discussion

5.1 Students' Questionnaire

5.1.1 Goals

5.1.1.1 Learning Strategies VS Learning Results in the MISE

To identify the association between learning strategies and learning results, a cross-tabulation is shown in table 1, which presents the number and percentage of respondents that chose both a particular learning strategy and a particular learning results attribution. The learning strategies that achieved the highest number of selections were "Practice via exercises", "Summarizing learning content", "Searching and browsing online". As for the learning results, respondents mostly selected "Self-regulation", "Learning Strategies", "Engagement level", "Goal orientation" and "Motivation".

		Learning Strategies										
		Organizing your study (scheduling)	Practice via exercises	Memorizing via reading	Summarizing learning content	Asking questions to colleagues and teachers	Searching and browsing online	Take notes during classes	Watching educational videos / lecture videos	Association (Linking previous knowledge with new information	Organize information for more efficient recall and use	Total
Learning means attitude	Self-Regulation	16	18	12	17	14	18	3	19	11	8	23
		37.2%	41.9%	27.9%	39.5%	32.6%	41.9%	7.0%	44.2%	25.6%	18.6%	53.5%
	Learning Strategies	11	17	9	14	10	18	4	16	8	8	19
		25.6%	39.5%	20.9%	32.6%	23.3%	41.9%	9.3%	37.2%	18.6%	18.6%	44.2%
	Engagement Level (curiosity and involvement with the course)	16	21	10	20	13	21	5	22	12	7	26
		37.2%	48.8%	23.3%	46.5%	30.2%	48.8%	11.6%	51.2%	27.9%	16.3%	60.5%
	Goal Orientation	18	22	11	20	13	19	6	21	10	6	28
		41.9%	51.2%	25.6%	46.5%	30.2%	44.2%	14.0%	48.8%	23.3%	14.0%	65.1%
	Help from the Teacher	2	4	1	2	4	3	1	2	1	1	4
		4.7%	9.3%	2.3%	4.7%	9.3%	7.0%	2.3%	4.7%	2.3%	2.3%	9.3%
	Motivation	15	24	12	23	15	20	7	21	15	8	27
		34.9%	55.8%	27.9%	53.5%	34.9%	46.5%	16.3%	48.8%	34.9%	18.6%	62.8%
	I don't know	0	1	1	0	0	1	0	1	0	0	1
		0.0%	2.3%	2.3%	0.0%	0.0%	2.3%	0.0%	2.3%	0.0%	0.0%	2.3%
	Another	0	1	0	0	1	1	0	0	0	0	1
		0.0%	2.3%	0.0%	0.0%	2.3%	2.3%	0.0%	0.0%	0.0%	0.0%	2.3%
Total		24	35	17	28	20	32	6	32	15	10	43
		55.8%	81.4%	39.5%	65.1%	46.5%	74.4%	18.6%	74.4%	34.9%	23.3%	100.0%

Percentages and totals are based on respondents.

Table 1: Learning Strategies VS Learning Results

5.1.1.2 Students' Opinions on Distance/Online Learning

Students were asked their opinions on distance learning. The advantage students found most relevant was "accessibility" (study anytime, anywhere), which was selected by 93% of the students; followed by "affordability" (42%). The less-selected advantages were "teacher availability" (16%) and "interactivity" (17%).

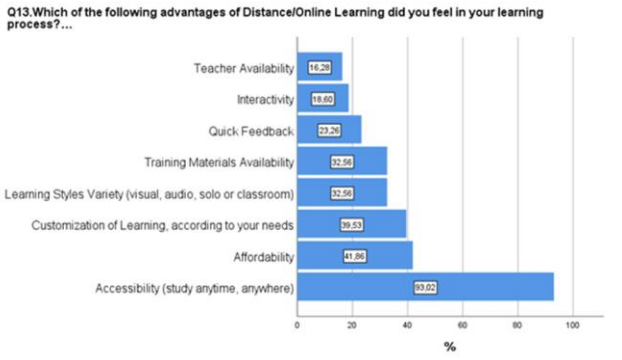

Figure 2: Distance Learning Advantages selected by the students

The most referred disadvantages were "blurred barrier between work and home life" (43%), "isolation" (38%) and "poorer quality feedback" (38%). The least referred was "questionable credibility of the degree" (14%).

60% of students found synchronous interactions more helpful than asynchronous. When asked to rate the amount of interaction with the teacher and with colleagues in the distance/online learning, as opposed to classroom learning (using a five points Likert scale, where 1 = much less interaction and 5 = much more interaction), students rated more positively the interaction amount with colleagues than with teachers, where 60% of the students rated up to 2 the interaction with teachers opposed to 30% the interaction with colleagues on the same scale classification.

Students were also asked to relate the importance of interaction with teachers and students in the learning process and 37% considered the interaction with teachers hindered the learning process and 28% did not think the interaction with teachers was important in the learning process. 42% of students considered the interaction with colleagues important in the learning process, 26% don't think the interaction with colleagues is important in the learning process and 21% considered that interaction was negative to their performance.

Students rated their engagement level in this master's using a five-point Likert scale (1 = Much lower to 5 = Much higher). Nearly 100% rated this master's as engaging or more than a traditional degree.

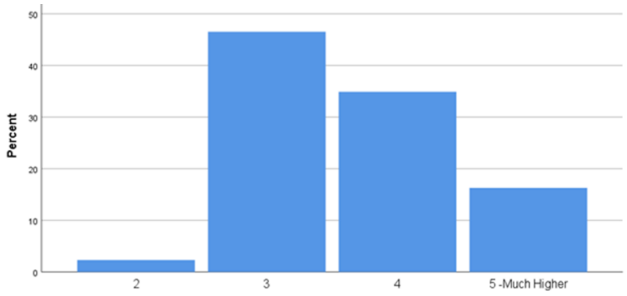

Figure 3: Engagement level in the MISE compared to a traditional degree

40% of the students stated they didn't participate much in asynchronous online discussions, however they felt that they got solid results and 35% of the students felt that the participation effort in asynchronous online discussions matches the final grade.

Around 50% of the students considered that distance learning positively affected their engagement levels in TICE and COAO courses and around 14% considered that negatively.

5.1.1.3 Correlation and Association Analysis between Questionnaire Items

A correlation analysis was conducted between items from the questionnaire (Table 2) to find potential correlations between questions' answers. A moderate correlation was found between Question (Q) 16 and Q18; Q22 and Q24; Q24 and Q29; Q11 and Q12. A strong association was verified on the pair of items: Q17 and Q19; Q25 and Q26; Q30 and Q31.

Item	Item	Coefficient
Q7 How would you rate your ease to self-regulate your learning?	Q9. Do you tend to use different Learning Strategies, when tackling different courses?	0.157*
Q16. Please rate the amount of interaction with the teacher in distance/online learning, as opposed	Q18. Please rate the amount of interaction with colleagues in distance/online learning, as opposed to	0.525*

to traditional classroom learning.	traditional classroom learning.	
Q16. Please rate the amount of interaction with the teacher in distance/online learning, as opposed to traditional classroom learning.	Q20. How would you rate your Engagement Level in this master's, as opposed to a traditional degree (a non-distance learning degree)?	0.287*
Q18. Please rate the amount of interaction with colleagues in distance/online learning, as opposed to traditional classroom learning.	Q20. How would you rate your Engagement Level in this master's, as opposed to a traditional degree (a non-distance learning degree)?	0.327*
Q22. How engaging do/did you find this course (TICE)?	Q24. How would you rate your ease to self-regulate your learning for this course (TICE)?	0.627*
Q27. How engaging do/did you find this course (COAO)?	Q29. How would you rate your ease to self-regulate your learning for this course (COAO)?	0.334*
Q22. How engaging do/did you find this course (TICE)?	Q27. How engaging do/did you find this course (COAO)?	0.426*
Q24. How would you rate your ease to self-regulate your learning for this course (TICE)?	Q29. How would you rate your ease to self-regulate your learning for this course (COAO)?	0.627*
Q11. Do you feel that your effort in this master's generally matched your final grade?	Q12. Do you feel that the final grades of the courses you took generally match the knowledge you gained?	0.633¥
Q17. Do you think that difference in amount of interaction with the teacher was important to your learning process and final grade?	Q19. Do you think that difference in amount of interaction with colleagues was important to your learning process and final grade?	0.705¥
Q25. Do you feel that your effort matched your final grade (TICE)?	Q26. Do you feel that your final grade matches the knowledge you gained (TICE)?	0.755¥
Q30. Do you feel that your effort matched your final grade (COAO)?	Q31. Do you feel that your final grade matches the knowledge you gained (COAO)?	0.755¥

*Spearman's Coefficient; ¥Contingency Coefficient

Table 2: Spearman's Correlations and Contingency Association Coefficients between Questionnaire Items

The correlations between Q11 and Q12; Q25 and Q26; Q30 and Q31 contribute to answering the 3rd goal of the questionnaire (Compare students' perceived effort with their performance and knowledge gained in two courses (TICE and COAO) of the MISE).

5.1.2 Overall Engagement in the MISE

A global score was obtained by adding the items 7, 9, 16, 18, 20, 22, 24, 27 and 29 of the questionnaire, which are in a Likert scale (1=very hard to 5=very easy). This score ranges between 9 to 45, with higher scores being synonymous with higher engagement. The mean (± standard deviation) is 31.7 (± 0.7) and a minimum of 24 and a maximum of 42.

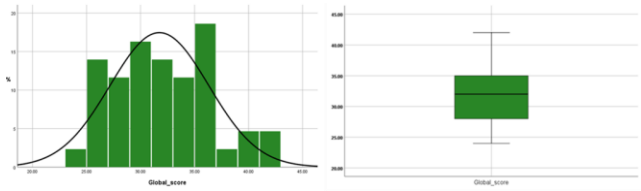

Figure 4: Global Score Distribution. A) Global Score Histogram B) Global Score Boxplot

Comparing the global score between genders, no statistical differences were found using a t-test for independent samples ($t = -0.058$, $p = 0.954$), since the normality distribution was verified for global scores for both gender samples.

A one-way ANOVA was performed to compare the mean scores between group ages. Since normality and variances homogeneity was verified, significant differences between group ages ($F = 4.69$, $p = 0.004$) were found. The group age that achieved the best score results was 34 and 41 years old.

5.2 Teachers' Questionnaire

When asked how they would rate their students' ease to self-regulate on a scale of 1-5, 43% of teachers rate it a 3 (average) and 57% rated it a 4 (easy). When it comes to their students' engagement in the curricular units they teach, 14% of teachers gave them a 3 (average), 57% gave them a 4 (high) and 29% gave them a 5 (very high). As to how their students' engagement affected their final grade, 14% of teachers rated it a 4 (quite a bit) and 86% rated it a 5 (a lot).

When rating students' interactions, teachers generally believe students interact an average amount with them. As for the quality of interactions with the students, 86% of teachers rate it from high to very high. 86% of teachers also believe students have high to very high-quality interactions with technology. Since most of the interactions in the MISE are asynchronous, teachers were asked to rate students' engagement in asynchronous interactions from 1-5

(very low to very high). The results show very scattered opinions, as can be seen below:

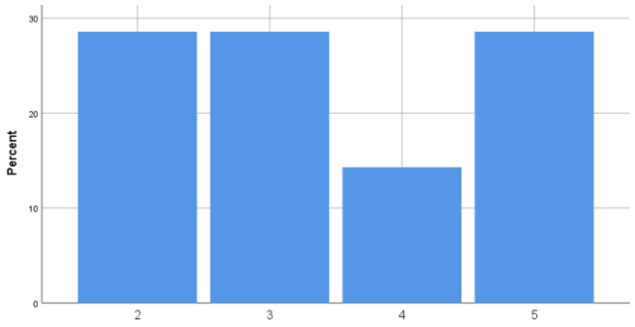

Figure 5: Students' Engagement in Asynchronous Interactions (1-5 scale)

Finally, as to how students answered to the pedagogical strategies teachers used, 86% of teachers rated their students' reaction to their pedagogical strategies 4-5 (well to very well).

From what has been shown in the students' and teachers' questionnaires, one can conclude that teachers judge the engagement of their students as high, which aligns with students' opinions about the engagement of the MISE. Teachers (agreeing with students) also believe that engagement is an important factor in achieving better learning outcomes.

However, regarding the interactions between students and teachers, the opinions of both parties differ.

Teachers believe that the amount of interactions is more or less the same, as in traditional teaching models, and the quality of interactions is high to very high.

On the other hand, most students believe that they interact less with teachers and 65% of the students considered that the interaction with teachers made the learning process difficult or was not important for the learning process.

Besides, there is a low association between the amount of interaction with the teacher and the level of engagement of the students (Q16 and Q20) and only 9% of students attributed their learning outcomes to "help from the teacher", which is consistent with their views on teacher interaction.

Most students considered synchronous interactions more useful than asynchronous interactions, which may explain students' unhappiness with their teacher interactions, since the pedagogical model of the MISE focuses mainly on asynchronous interactions.

6 Conclusions

6.1 Questionnaires and Data Analysis

The data that the questionnaires provided was analyzed using the IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp, Armonk, NY, USA).

When analyzing the data, both questionnaires' results were compared and comparing how engagement affects learning outcomes, 60% of students attributed their learning results to their engagement level and all teachers attributed 4-5 (quite a bit – a lot), in a likert scale.

There is almost a consensus from both students and teachers on the importance of engagement to learning outcomes, with teachers giving it more importance than students. 86% of teachers rated their students' engagement in the curricular units they teach as either high or very high.

With also 86% of teachers stating their students' engagement very highly affected their final grade and 86% of teachers rated their students' reaction to their pedagogical strategies from well to very well. One can then assume that either teachers' pedagogical strategies can generate engagement in their students, or students are intrinsically engaged from the start (meaning they don't need much external help to be engaged), or both.

Also, nearly 100% of the students rated the MISE as engaging or more than a traditional degree. This might be attributed to the autonomous learning that distance learning requires. Students become more emotionally connected and invested in their learning by being more responsible for their learning and outcomes.

Also, the students' sample consisted mostly of people who are full-time employees (79%) and over 34 years old (70%), meaning they are not dependents (as in, they don't have someone to fund them and their endeavors), so they have a greater sense of the value of the money and time they spend. By investing in their education, these students have a generally higher bond with what they are investing in, opposed to patroned students. Another narrative that favors the idea of the importance of intrinsic motivation.

When it comes to student-teacher interaction amount, the opinion of both parties involved is different. While teachers seem to believe it to be about the same as traditional classroom learning, 59% of students believe that they interact less with teachers, with only 12% considering they interact more with teachers. However, 86% of teachers rate the quality of interactions with the students from high to very high.

This means that, unlike in traditional classroom learning, where students pose their questions when they think of them, maybe due to the lesser degree of interaction with teachers in distance learning (according to the students), students first perform

research and if they still don't find an answer to their question, only then do they ask their teacher.

This narrative would explain the low amount of interaction with teachers, but the interaction is of high-quality. However, when relating the importance of interaction with teachers in the learning process, 28% didn't think interaction with teachers was important in the learning process.

Worse, 37% of students considered that the interaction with teachers hindered their learning process. Most students (60%) found synchronous interactions more helpful than asynchronous, which might explain students' displeasure with their interaction with teachers, as MISE's pedagogical model mostly focuses on asynchronous interactions.

Not only is there a negative opinion of a majority of students on the teachers' effect on the learning process, but table 3 also displays a low association between the amount of interaction with the teacher and the student's engagement level in the course, meaning that the amount of interactions with the teacher has little effect on the engagement level of students (Q16 and Q20).

The same is the case for interactions between students, with only a slightly higher correlation coefficient (Q18 and Q20), even though students state that the amount of interaction with colleagues in distance learning is, on average, virtually the same as in traditional classroom learning experiences.

Additionally, table 3 also shows a strong association between how the difference (from traditional classroom learning to distance learning) in the amount of interaction with the teacher affects the learning process and final grade and how the difference (from traditional classroom learning to distance learning) in the amount of interaction with colleagues affects learning process and final grade (Q17 and Q19).

The results of the correlation between students' participation effort in asynchronous online discussions and their final grade were very mixed, with 35% of the students having good learning outcomes and good participation and 40% of students having good learning outcomes, despite low participation. This leads to the conclusion that asynchronous interactions may not significantly contribute to a student's final grade in distance learning.

When analyzing what students attribute their learning results to, only 9% attribute it to "help from the teacher" which is consistent with their views on interaction with the teacher in a distance learning environment.

However, the two options that showed in first and second place in the learning results attribution chart were "Goal Orientation" and "Motivation" two things that are mostly intrinsic motivation, which might mean that even if the teacher does a perfect job, if the student is not intrinsically motivated to learn, the student won't have very good learning outcomes.

When rating students' engagement, as per their questionnaire's results, their global engagement score shows that most students found themselves with a score between average and high. So, while rating their engagement as positive, students don't rate their engagement as positively as teachers (since 86% of teachers rated their students' engagement in the curricular units they teach as either high or very high).

A potential explanation could be that teachers rated their students' engagement based on the amount and quality of the students' interactions with them in the forums and how much effort it took for teachers to address the issues posed in the forums.

In contrast, students might have rated engagement more as a measure of their interest in and during those interactions and forums. According to the students, the biggest advantage they found in distance learning is, by far, "Accessibility", the ability to study anytime, anywhere. 93% of students selected it, with the second being "Affordability" at 42%.

This shows that students want to be able to study what they want, when they want. This means there is an opportunity for higher education institutions to embrace lifelong learning by offering more customized, smaller curriculums, developed together with industry.

Regarding the two subjects picked for the questionnaire (TICE and COAO), while for TICE there was a moderate correlation between how engaging students found the course and how they rate their ease to self-regulate their learning for the course (table 3, Q22 and Q24), for COAO, this correlation was weak (Table 3, Q27 and Q29).

Making the correlation between engagement and self-regulation unclear. However, a moderate correlation was found between self-regulation for TICE and self-regulation for COAO. This might mean that either:

- Students' who self-regulate well for one curricular unit, are statistically more likely to self-regulate well for other curricular units;
- On TICE and COAO, similar learning strategies can be used to achieve good learning outcomes.

As was stated before, the correlations between Q11 and Q12; Q25 and Q26; Q30 and Q31 from table 3 contribute to answering the 3rd goal of the questionnaire (compare students' perceived effort with their performance and knowledge gained in two courses (TICE and COAO) of the MISE).

Two of these sets of items (Q25 and Q26; Q30 and Q31) have a strong association and Q11 and Q12 have a moderate correlation.

This leads to the conclusion that students' effort generally matches their knowledge acquisition (Q11 and Q12).

6.2 Limitations and Future Work

The clearest limitations found in this research were three:

- Sample Size;
- The Experiment's Setting's Range;
- Engagement Analysis Tools;
- Chosen Methodology

The sample size is small, with the students' questionnaire obtaining 43 answers out of 118 and the teachers' questionnaire obtaining 7 out of 13. The experiment's setting comprised only one course from one university, instead of many courses from many universities, which would have increased the scope and range of the research. And to analyze student engagement, the data gathered and analyzed originated from questionnaires, whereas it could have also originated from:

- Interviews and Focus Groups;
- Online Cognitive Assessment Tools;
- eLearning Platform Data (for example interactions in the forums, hours spent on the platform, and so on…);
- etc…

Regarding the chosen methodology, while it is serviceable to study the issue at hand, it does not feature information systems, as much as would be expected from a Master's degree in the area of Information Systems.

Future work could complement this research study by diving into analyses of the LMS's role in students' cognitive engagement, since LMS are the key learning tool in distance learning and were left mostly out of this study. Future researchers can also do this research for the other two engagement types (emotional and behavioral engagement), professional training, or both.

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