How Cognitive Engagement Strategies' can improve Learning Outcomes in Higher Education: Position Paper

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Abstract

Students have been becoming more autonomous, which opens the window to innovative intervention that cognitively engages students. The current contexts of collaborative and self-learning, inserted in technological environments designed for Digital Learning, allow the achievement of different performances at different levels. This article's main objectives are the identification of cognitive engagement strategies and to verify the existence of a correlation between these strategies and learning outcomes, in a higher education context. In this context, this research aims to identify what are the main cognitive engagement strategies for higher education contexts, what technological environments are available for applying cognitive engagement solutions and what correlation exists between the proposed strategies and learning outcomes, in digital learning environments.Based on an Action Research methodology, this position paper presents the state of the art regarding Cognitive Engagement and Learning Outcomes in Higher Education and a literature review. Future work is discussed.

Keywords: Higher Education; Cognitive Engagement; Learning Outcomes

1. INTRODUCTION

Digitization has drastically modified students' daily lives and activities (Anthonysamy et al., 2020). 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 and have been becoming 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). It is considered, by Solis (2008), a necessary requirement for students' meaningful learning (as cited in Shukor et al., 2014; Galikyan & Admiraal, 2019; Malecela & Hassan, 2019). Cognitive engagement is a good indicator of learning success (Lei et al., 2018; Shukor et al., 2014), since students who use cognitive and learning strategies generally have better learning outcomes (Ramirez-Arellano et al., 2018; Wu et al., 2020). 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). Shukor et al. (2014) state that evaluating students' cognitive engagement is a fruitful way of evaluating the

quality of online learning, where the quality of online learning reflects a specific standard at which students are cognitively engaged.

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). This type of learning can be online or offline. 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. Additionally, digital learning can simultaneously be highly interactive and isolating, since there are intrinsic challenges in developing adhesiveness, resulting in low interaction between students (Choudhury and Pattnaik, 2020).

Anthonysamy et al. (2020) conclude in their study 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).

Richardson and Newby (2006) found that as students become experienced with online learning, they start taking more responsibility for their learning.

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). Vrasidas and McIsaac (1999) stress the need for online facilitators to observe the occurrences and results of these interactions when creating and delivering online classes (as cited in Chakraborty & Muyia Nafukho, 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). Results from the study conducted by Anthonysamy et al. (2021) showed that higher education students used these cognitive engagement strategies and that they positively related to better learning outcomes in their digital learning.

In Galikyan and Admiraal's (2019) research into engagement in asynchronous discussions online detected a statistically significant relationships between cognitive engagement and the final mark of the course. In agreement with current literature, the results indicate that online discussion forums have the potential to help maintain the momentum of a conversation and broadening its focus, which will stimulate reflection outside the classroom (Galikyan & Admiraal, 2019). Promoting student interactions and participation in online discussion forums through thought-provoking student discussions and dialogue may lead to higher-performing learning networks, where the interactions create knowledge, which is linked with better learning outcomes (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 very time-consuming (Shaw et al., 2019). Online cognitive assessment tools can be useful, due to their flexibility (Shaw et al., 2019). These tools allow teachers to quickly deliver complete feedback to students, enabling students to self-regulate more effectively (Miller, 2009, as cited in Shaw et al., 2019).

If students use cognitive strategies, they are more likely to become proficient in the learning content (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. Terrenghi et al. (2019) found that flipped classroom appears productive in improving cognitive engagement and as students put more effort and use cognitive strategies, they learn more effectively.

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). Anthonysamy et al. (2020) argue that digital learning problems can be faced by using self-regulated learning strategies.

4. METHODOLOGY

This paper used the action research methodology. Action-research is a reflective, situation- and context-based investigation method, which aims to create change via both action and research, which are linked together by critical reflection (O'Brien R., 1998). This method is often used in learning contexts, such as how to increase student performance, due to its ability to improve participants' reasoning skills and assist them in developing self-monitoring measures to increase performance effectiveness (Koshy, E., Koshy, V., & Waterman, H.,

2011). Action research can also be strongly linked to action learning (learning from experience), particularly in an organizational context (O'Brien R., 1998).
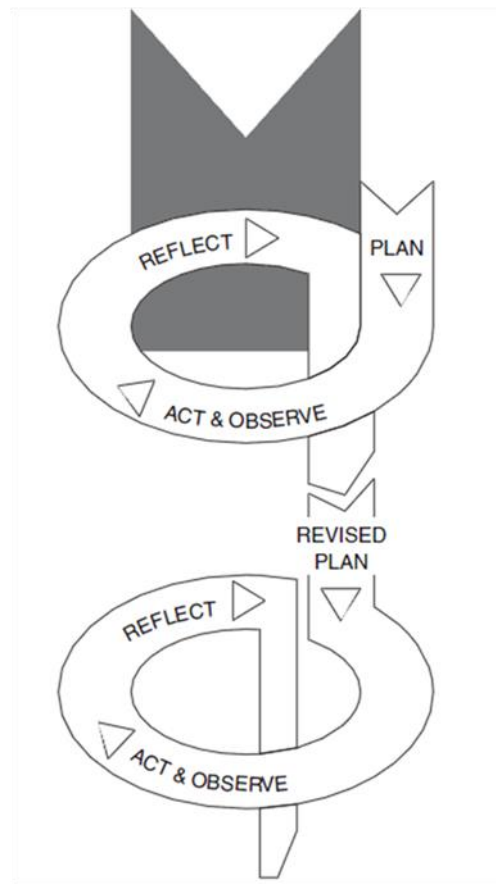

Figure 1 – Kemmis and McTagart's (1998) Action Research Spiral (as cited in Koshy et al., 2011).

Action research is a cyclical process that involves planning for change, acting and observing the process and consequences of change and critical reflection on these processes and consequences (O'Brien R., 1998). These processes result in practical changes, in addition to generating theoretical knowledge. When these solutions are implemented and start to change the environment, a new set of circumstances emerges with different problems, which require a new examination (Koshy, E., Koshy, V., & Waterman, H., 2011).

Given the wide use of this methodology in contexts of learning and performance improvement, combined with practical results and its collaborative and participatory nature, make the action research methodology a preferred research method for this research study.

Given that this action research study is presented in the area of social sciences and in the context of the evolving experiences of those involved, a qualitative tradition is needed that takes the personal experiences of participants into account (Heikkinen et al., 2012). The qualitative tradition that most identifies with this is the narrative (Heikkinen et al., 2012; Toledano & Anderson, 2017). Toledano and Anderson (2017) argue that the subjectivity of the narrative method can be used as an analytical force in action research. Heikkinen et al. (2012) refer to the existence of several action-research reports that are often narrative, located in the contexts

mentioned above. Heikkinen et al. (2012) highlight the relevance of the following for the reconciliation of the action research methodology and the narrative method:

- Recognition of the past path that shaped present practices;
- The principle of reflexivity in learning;
- Elaboration of history dialectically;
- Production of usable and useful practices by the research.

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).
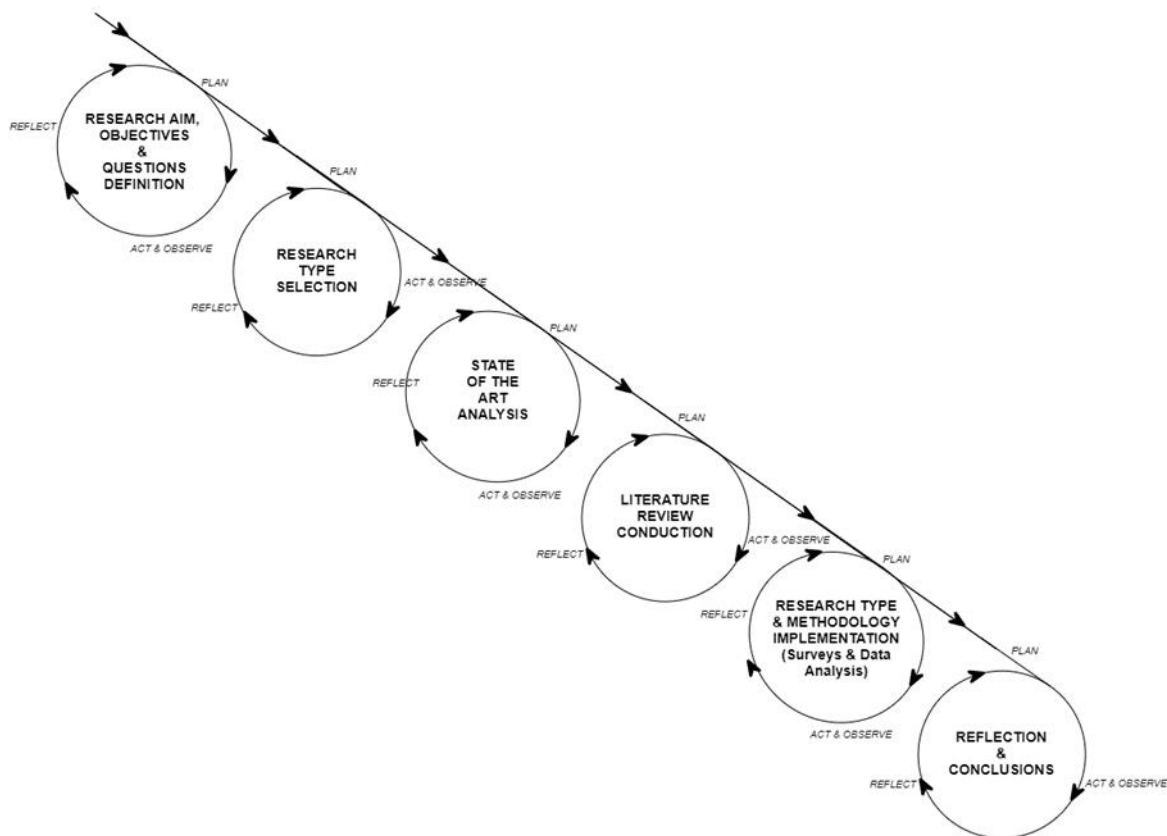

Figure 2 – Research Methodology Diagram.

Then, the primary data will be 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 will be students of a distance learning online masters. This questionnaire will aim 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 will be professors and coordinators of the same distance learning online masters. This questionnaire will aim to understand how the master's distance learning model affects student engagement.

Both questionnaires will follow 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. CONCLUSIONS AND FUTURE WORK

Cognitive Engagement and its deep strategies seem to have a positive connection with academic achievement and learning outcomes (Galikyan & Admiraal, 2019; Gunuc, 2014, Sedaghat et al., 2011). Past studies decisively state that, online students have increased cognitive engagement and learning outcomes when using self-regulated learning strategies (Sedigheh, Rashid, & Reza, 2012; Haron et al., 2015, as cited in Anthonysamy et al., 2020). So, teachers should help students develop these skills and make self-regulation a habit by applying self-regulation skills in class (Anthonysamy et al., 2020).

Teachers also have to be aware that there are many variables that can influence online interactions and cognitive engagement and teacher should use them to nurture interaction and cognitive engagement (Zhu, 2006). Galikyan and Admiraal (2019) suggest instructing students on monitoring their cognitive and learning performance and interactions in discussion forums, by using automatic analysis of learner-generated data. Course creators should use student inputs to online forums, as a way to evaluate students' cognitive engagement, so they can continuously design courses and modify them, so they make use of the traits of text-based communication that promote critical thinking and positively affect students' cognitive engagement and learning outcomes in open and distance higher education environments (Galikyan & Admiraal, 2019; Joo et al., 2014).

Taking advantage that students tend to be the most engaged during the evaluation periods, online cognitive assessment tools can be used to enhance learning outcomes and higher education institutions and teachers should educate students on cognitive strategies and online cognitive assessment tools (Shaw et al., 2019).

This research will collect additional data through the questionnaires. The data acquired in both questionnaires will be analyzed using the SPSS software. The data will be coded into categories, which will be created taking into account the literature review. The information will later be read to obtain a general idea of the adapted information, information that will then be coded to develop, classify, summarize and describe aspects that will be addressed in the dissertation. The findings will subsequently be interpreted and validated.

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