Metacognitive skills in the methodology of intellectual work using the virtual classroom in higher education

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Abstract

Society is increasingly in need and interested in developing skills that allow finding solutions to current problems and thus contribute to the construction of a better world, one of them are metacognitive skills. Therefore, this article investigated the correlation between the variables of metacognitive skills in the methodology of intellectual work with the use of the virtual classroom in a Peruvian university. The article is of a descriptive correlational type with a sample of 100 students in the first cycle of the professional careers of business administration, hotel, and services administration, and law at a university. Two instruments validated by specialists were applied in the research, the first on metacognitive skills and the second on the use of the Moodle virtual platform. After analyzing the results, it was concluded that there is a significant Pearson correlation (r = 0.553), of moderate degree, between the development of metacognitive skills and the use of the Moodle virtual platform; therefore, the more students use the platform, the better their metacognitive skills will be developed and, therefore, their competencies in the subject of Methodology of Intellectual Work.

Keywords: Skills, metacognitive, methodology, virtual classroom, higher education.

Introduction

Today, in the technological era, new concepts and virtual tools are being generated, therefore, society needs to develop skills to use these tools to find solutions to current problems and thus contribute to the construction of a better world, and one of these skills is the metacognitive skills.

Metacognitive skills are defined as productive mental habits that students show, in a stable way, the ability to use to learn in any scenario and understand when and why it is necessary to apply certain practices (Marzano and Pickering in Pacheco and Alatorre, 2018). According to the Metacognitive strategy, teaching places the student at the center of the educational process and increases his ability to elaborate his knowledge through questioning, generating that his learning is based on understanding, and this leads to the consolidation of information in an organized way (Al-Asadi in Abase et al., 2022)

Etymologically, metacognition is derived from the origin 'meta' meaning beyond, thus defined as "thinking about thinking" and "knowing about knowing". Flavell (1976) defines metacognition as "one's knowledge about one's cognitive techniques or anything related to them, e.g., the learning-relevant properties of information or data" (Trainees and Mandal, 2022, p.264)

For Cerchiaro et al. (2021), problem-solving in digital formats can be useful to assess metacognition and propose innovative strategies to promote its development. By including this procedure, we bet on a transformation of the pedagogical processes aimed at the development of high-level cognitive skills and competencies in the use of ICT, increasingly essential in the current technological reality (p. 18)

Also, a virtual learning environment makes available new languages to organize the learning process. As for students, these cognitive processes present in virtual environments, set the need to know them, determining the level of awareness of how they learn, and how the processes are assumed to transmit and exchange information with other students and with the teacher. For the student to achieve his learning objectives, among the teacher's objectives must be present: to develop the competencies of his subject, as well as to increase through pedagogical-technological activities the development of his students' metacognitive skills (awareness, control, and autopoiesis).

It is worth mentioning that due to the constant innovations that are taking place in society, education has seen the need to look for different mechanisms focused on the student, which allow an interrelation between content, pedagogy, and technology. So, because of these technological advances and their influence on education, the present research was developed, in which the correlation between the use of the Moodle Platform and the development of metacognitive skills in the subject of Methodology of Intellectual Work was evaluated. For this purpose, a descriptive correlational study was carried out by applying two questionnaires, the first concerning metacognitive skills and the second on the use of the Moodle Platform, to a sample of 100 students in the first cycle of the professional careers of business administration, hotel and services administration and law of a Peruvian university.

Within this context, the Moodle Platform was selected because it has an innovative methodology, i.e., thanks to the different activities that can be proposed, the possibility of carrying out meetings between teachers and students is expanded, which reinforces the possibilities for learning through the use of its various tools. Also, on the practical side, the use of this platform allows teachers to help their students to develop a series of skills and acquire basic competencies in the use of information and communication technologies, such as reading in digital information sources, writing with word processors, and communicating through computer networks.

Finally, this study is important because as the students develop the activities proposed by the teachers through the Moodle Platform, they will acquire and enhance their metacognitive skills and thus become aware of their learning process in a reflective way.

1.1. Metacognitive skills

Metacognition is a recent concept in educational psychology, it owes its origin to (Flavell) in 1976, the concept comes from the exploration of the processes of human memory, where the pedagogue plays a substantial role in the development of metacognitive strategies, in the programming of the strategy to learn, the presentation, the orientation of the practice and obtaining feedback from students during its application (Abase et al., 2022).

John Flavell refers to metacognition as the knowledge that an individual possesses about his or her cognitive processes and products, and the monitoring and regulation of these processes in function of the achievement of an objective or goal (Cerchiaro et al., 2021, p. 232). Likewise, Flavell was right to mention metacognition as a promising area of research, since it is currently one of the most examined topics in psychology and education, establishing itself as the nexus between cognitive psychology, education, and teaching and is related to practices such as reading, writing, learning, problem-solving, playing digital games, among others. Metacognition is a predictor of performance in learning tasks (Valenzuela in Cerchiaro et al., 2021)

Several studies have also demonstrated the importance of teaching and learning metacognitive skills to improve lifelong learning (Kallio et al., 2018, p.113). Slavin (2019) states that metacognition is knowledge about your learning, how you learn, and monitor. In addition, there are several aspects contained in metacognition that experts have raised (Afni et al., 2022, p.7955). Likewise, metacognitive aspects are considered fundamental, as they are necessary skills in the 21st century, similar to higher order thinking skills, since they involve aspects of comprehension, analysis, and control of cognitive processes (Afni et al., 2022)

In addition, metacognition is the ability of an individual to reflect, understand and control his or her cognitive processes; it is associated with high-level psychological processes to rationalize and self-regulate other cognitive functions and one's behavior. It is also related to improved academic performance and greater skill in decision-making, critical thinking, and complex problem solving (Escolano-Pérez et al. in Cerchiaro et al., 2021).

Educational practices based on cognitive theory are concerned with developing students' cognitive, metacognitive and motivational skills; such experiences emphasize how to learn as a means of developing concrete learning skills. The failure of many students to learn is not only due to cognitive problems but also to metacognitive problems; generally, the difficulty is on the part of the students, who cannot use their knowledge and skills and transfer them to other situations (Davis et al., in Bastani et al., 2011)

Hernández (2002) mentions that metacognition and meta-emotion are present in the action of creating, and therefore proposes to pursue a deep learning process that is not only cognitive, to the extent that what we do involves our desire, captures our imagination and builds our consciousness (Caeiro-Rodríguez, 2018)

Metacognition does not only refer to knowledge about cognition. Metacognition is nowadays conceived as a high-level process period, obtained and developed by experienced and the sum of concrete knowledge. It is thanks to this superordinate process that the person is competent to observe, control himself and develop tactics to optimize his cognition (Flavell, 1987). Thus, metacognition has been of great importance in educational proposals that employ metacognitive strategies in learning (Jou and Sperb in Bastani et al., 2011)

Schraw (2002) postulated that cognitive abilities were wrapped within subjects, and metacognitive skills spanned multiple domains, and tasks and manifested flexibility in new learning events (Schraw and Moshman in Gutierrez and Montoya, 2021). Lysaker et al. (2005) state that metacognition contains four major skills, including self-reflexivity, which refers to the ability to think about one's mental states; differentiation, the ability to think about the mental states of others; decentering, the ability to understand that there are different ways of conceiving reality; and mastery, the ability to integrate intersubjective information into broad definitions of problems that allow an adaptive response (Inchausti et al., 2017)

Metacognitive strategies comprise people's abilities to plan, monitor, and moderate their cognition for the implementation of their cognitive strategies. Two components are considered in metacognition: knowledge and knowledge regulation (Flavell, 1979). There are manifestations of the importance of metacognition in motivational training (Barca-Lozano et al., in Nieto-Márquez et al., 2021), motivation has a positive result in achievement experiences (Landine and Stewart, 199; Nieto-Márquez et al., 2021)

Pereira-Laird and Deane (1997) argue that metacognitive strategies involve planning, monitoring, and regulating activities, at all times, in the thinking activity. Unlike cognitive strategies that integrate new knowledge with past knowledge. Cognitive strategies that learners employ to elicit, educate, recall, retrieve, and comprehend material while reading include rehearsal, elaboration, and organizational strategies (Rani, 2022)

Age is a relevant element in the analysis of metacognitive skills, executive functions, and motivation orientation; metacognition is optimized with age, possibly due to the inexperience of students in the use of strategies or skills they have in the early stages of learning (Lara Nieto-Márquez et al., 2021).

The assessment of metacognition represents a challenge for several reasons, as metacognition is a complex construct, involving a range of different types of knowledge and skills, it is not observable, it is confounded in practice, and existing measures tend to be narrow in focus and decontextualized from school-based learning (Lai in Pacheco and Alatorre, 2018)

1.2. Using the Virtual Classroom

Nowadays, humans live in a technological environment whose effect on classroom practices involves greater use of digital resources and diversifications in lesson planning that encourage collaborative work in knowledge construction (Area and Sanabria in Romero-Gutiérrez et al., 2018). In this sense, the Covid-19 pandemic has impacted teaching and learning methods at all levels of education. Online education seems to have the capacity to transform the entire educational system in scope, access, flexibility, and ability to restore dropout rates. This makes it imperative to examine and understand the effectiveness and impact of this mode of education on the competencies and holistic development of students (Balan et al., 2022)

In online education, teachers must use their potential to design learning management that integrates content knowledge, pedagogical knowledge, and technological knowledge (Klomkul and Pansa, 2022). Also, the challenges that learners experience in online education depend on different elements such as gender, age, skills, and knowledge, as well as the context in which they learn (Sharma et al., 2021)

In this context, the University implemented a self-developed platform that has been evolving according to its needs. In March 2006, some adaptations were made to the virtual classroom and pilot tests of the use of the platform in undergraduate courses, so that some of the professors could use this tool as a document repository. The second version of this platform was implemented in August of the same year, and it incorporated tools for monitoring assignments and asynchronous communication such as forums and agendas. The use of this version was more widely accepted by professors as a resource for the development of their subjects. The Moodle Platform is considered a Virtual Educational Environment, a freely distributed course management system that helps educators create online learning communities.

In March 2007, the third version of this platform was developed with some standard tools that every platform should have: activity calendar, document publication, forums, homework, chat, surveys, evaluations, student tracking, email sending, etc.

One limitation presented in the use of this platform is that most of the professors use it as a document repository and for the follow-up of assignments requested by students. Others argue that the tools offered by this platform are very limited or have their flaws, i.e., they were not sophisticated; for example, the chat tool was very basic and always hung; the forum was used to respond in a linear but not cyclical way and did not encourage interaction; it was not possible to schedule online exams; the questionnaire tool was a standard atlas (template) that often did not fit the subject; now, in the new platform, there is flexibility in the way of evaluating.

After several studies carried out by the Virtual Education Unit, the implementation of a Moodle platform was proposed to the University. With the approval of the academic authorities, in August 2011, a new virtual classroom was launched on the Moodle platform to be in line with the use of new technologies and international standards that help the optimal achievement of student learning. Currently, the Virtual Classroom is part of the Integral System of the Systems Development area. The virtual classroom should encourage, above all, the acquisition of knowledge and information through inquiry, but for this, teachers must develop their educational materials in a different way than they are used to. Teachers must embody creativity, interactivity, interaction, flexibility, coherence, and relevance. The following are some background studies of different researches carried out concerning the variables under study (metacognitive skills and use of the Moodle Platform),

As mentioned, new technologies have a great impact on education: the teacher is the one who plans and structures his work taking into account the new technologies (oriented to the achievement of meaningful learning) and the institution uses them to improve communication between management-teacher, teacher-student, and external groups

METHODOLOGY

The present study corresponded to a descriptive correlational, non-experimental research. The population consisted of 420 students and the sample consisted of 100 students of the I Cycle of the professional schools of business administration, hotel, and services administration, and law who studied the subject of the methodology of Intellectual Work in the 2011-II cycle. For the realization of this research work, the following techniques and instruments were considered, which allowed for selecting and extracting essential information from different bibliographic sources. The instruments used were the textual, summary, and commentary cards; field techniques, and direct observation techniques. It was used in the first approach to reality, but due to the nature of the study an asystematic observation was made; the survey technique was applied, which was structured by a set of written questions and organized through the questionnaire instrument.

RESULTS

Data analysis was performed with the help of SPSS version 19 statistical software. The data collected in the field phase were processed and tabulated in statistical tables for analysis and interpretation according to the objectives and hypotheses of the research. Pearson's correlation coefficients and tables with their respective graphs were determined.

Regarding the reliability of the instruments, Cronbach's alpha coefficient was used, concerning the metacognitive skills (.959), and concerning the Moodle Platform, the alpha was 0.883, which means strongly reliable. The following are the results obtained from the correlation between the variables under study: metacognitive skills and the use of the Moodle platform.

Table 1 Correlation between metacognitive skills and the use of the Moodle platform

		USE OF THE MOODLE VIRTUAL PLATFORM	META-COGNITIVE SKILLS
USE OF THE VIRTUAL_MOODLE PLATFORM	Pearson correlation	1	.553**
	Sig. (bilateral)		.000
	N	100	100
META-COGNITIVE SKILLS	Pearson correlation	.553**	1
	Sig. (bilateral)	.000	
	N	100	100

**. The correlation is significant at the 0.01 level (bilateral).
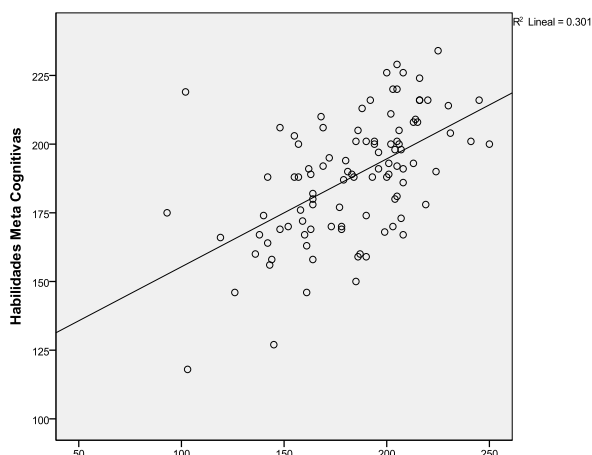Source: results obtained with the help of SPSS version 19 software.

Figure 1. Use of the Moodle platform
Source: results obtained with the help of SPSS software version 19.

Table 1 shows that Pearson's correlation coefficient test is highly significant ($p < 0.01$). Therefore, there is a significant relationship of moderate degree ($r = 0.553$) between the use of the Moodle Platform and the meta-cognitive skills of the students of the I Cycle. With these results, it is assumed that the more students use the Moodle Platform, the better their metacognitive skills will be developed and, therefore, their competencies in the subject of Methodology of Intellectual Work.

From the metacognitive skills questionnaire, it was identified that most students, when exposed to an activity that requires concentration and effort, activate their processes of remembering, thinking, and attending; most students have developed metacognition in the process since they are aware that there is an order and rules so that they can adapt to personal, academic and social environments. They are also capable of self-monitoring in these environments safely and efficiently, and students often organize their thoughts, making use of their meta attention, metacomprehension, metathinking, metalanguage, and metamemory skills.

Most students (many times) become aware that there is an order and rules to act in a given situation, which allows them to develop with greater security in the personal, academic and social spheres.

Most students think and become aware of the processes (thinking, remembering, and paying attention) that they carry out when thinking.

As for the least valued items of the variable metacognitive skills, meta-thinking is the metacognitive skill least developed by the students as a whole. Therefore, in the meta-thinking skill, the lowest ratings predominate. This leads us to conclude that a significant number of students do not feel that they have reached a positive level in the development of the ability to think and reflect on their cognitive processes.

In the questionnaire on the use of the Moodle Platform it is concluded that of the synchronous and asynchronous tools, the tools with the highest mean are the chat (synchronous tool) and the forum (asynchronous tool), indicating that they are the tools most used by the students. On the other hand, the tools that have the lowest mean are the quiz (synchronous), homework, and query (asynchronous tools), meaning that they have been the least used tools by the students. Of the two types of tools, both synchronous and asynchronous, the tools with the highest mean are the asynchronous tools, which means that students make more use of these tools.

DISCUSSION

Pearson's correlation coefficient showed that there is a significant correlation of moderate degree between the development of metacognitive skills and the use of the Moodle Platform in the students of the first cycle of the University under study, with values of $r = 0.553$ and $p = < 0.01$. Therefore, there is a significant relationship of moderate degree, it is inferred results that, the more students use the Moodle Platform, the better their metacognitive skills will be developed and, therefore, their

competencies in the subject of Methodology of Intellectual Work.

It is also stated that Trainees and Mandal, (2022) in their study, in which they reflect on metacognitive awareness and academic value in state university education students, mention that metacognitive awareness is mutually related to academic determination, that is, a student who makes an effort to study is more aware of his or her metacognitive knowledge. Also, Pacheco and Alatorre (2018) presented their research on critical thinking and metacognition in the teacher training process, where they identified that, in the evaluation of metacognition, educators do not have knowledge and training for the development of critical thinking, as a mental habit that helps metacognition, it is not possible to have the conviction that they are developing them in their students. Likewise, Bastani (2011) determined in his study that the training course on the development of metacognitive skills in teachers had an important impact, inducing changes in the pedagogical activity and the teachers' stimulation. The results allow affirming that the educator is a factor and mediator of cognitive and metacognitive changes in students.

For Abase et al., (2022) the metacognition strategy adds an atmosphere of enjoyment through the roles that students play during teaching since it encourages them to cooperate and participate. In addition to this, Balan et al. (2022) While the authors argue that student engagement is an essential measure for achieving learning outcomes, in online learning student participation is high in the academic area, however, learning levels are lower. While educators are provided to deliver online education, there is no process to address the different needs of students with different learning abilities.

In this way, Sharma et al. (2021) conducted a study in which he determined that online education became more important during the pandemic because it was unavoidable to transmute the entire educational system online, which was not an easy task, however, many efforts were made by teachers and institutions to meet the educational objectives.

CONCLUSIONS

Pearson's correlation coefficient reported that there is a significant correlation, of moderate degree, between the development of metacognitive skills and the use of the Moodle Platform, in the students of the first cycle of the University under study, with values of $r = 0.553$ and $p = < 0.01$.

Regarding the existing correlation between the synchronous tools (chat, questionnaire) of the Moodle Platform and the metacognitive skills, it is concluded that, of the two synchronous tools (chat and questionnaire), chat has a non-significant correlation ($p > .05$) with each of the five metacognitive skills (meta attention, metamemory, metacomprehension, metathinking, and metalanguage), since the values of the Pearson correlation coefficient test are not significant either, since their degree is very weak.

Of the correlation between the chat tool and the metacognitive ability of meta-thinking, the value of the Pearson correlation coefficient test lowest and closest to $p < 0.01$ is .085, whose degree of correlation is .173. On the other hand, the value of the Pearson correlation coefficient tests highest and furthest from $p < 0.01$ is .164, being found in the metacognitive ability of metacomprehension.

Of the two synchronous tools (chat and questionnaire), the correlation between the questionnaire tool with each of the five metacognitive skills is highly significant ($p < .01$), which means that the relationships of this tool with skills such as metaattention, metamemory, metacomprehension, metathinking, and metalanguage are very strong.

Of the questionnaire tool, the most significant Pearson correlation coefficient test value is .000, this value is present in the skills of meta-thinking, meta-attention, and metamemory, which means that the relationships of the questionnaire tool with the metacognitive skills of meta-thinking, meta-attention, and metamemory are very strong and more significant than in the rest of the metacognitive skills (metacomprehension and metalanguage).

In contrast, the least significant Pearson correlation coefficient test value among all the metacognitive skills is .004, which corresponds to the metalanguage skill. Therefore, the better the students' handling of the questionnaire, the better will be the development of the metacognitive skills of meta attention, metamemory, metathinking, metacomprehension, and metalanguage in the subject of Methodology of Intellectual Work.

In the correlation between the asynchronous tools (label, a text page, web page, linking to a file or a web, query, survey, wiki, forum, and homework) of the Moodle Platform and the metacognitive skills (metaattention, metamemory, metathinking, metacomprehension, and metalanguage). It is concluded that the correlation between the asynchronous tools (label, text page, web page, linking to a file or a web, query, survey, wiki, forum, and homework) of the Moodle Platform and the metacognitive skills (metaattention,

metamemory, metathinking, metacomprehension, and metalanguage) is highly significant (p < 0. 01); whose correlation is of moderate degree.

Of the asynchronous tools, all have a Pearson correlation coefficient test value of .000; except for the label tool, whose test values vary according to the type of metacognitive skill, thus in metaattention is .002, metamemory is .001, metathinking is .005, metacomprehension is .003 and metalanguage is .006. The maximum Pearson correlation degree of the label tool with each of the five metacognitive skills is .323, which corresponds to the metamemory tool. Consequently, the greater the use of the asynchronous tools of the Moodle Platform, the better the development of their metacognitive skills within the development of the Intellectual Work Methodology subject.

Therefore, it is recommended that the directors of the different professional schools should encourage their researchers to carry out similar studies, considering the variables of age and sex and that it be of an applied type, to know the influence of the Moodle platform in the development of metacognitive skills of students in different groups, according to their particular characteristics; since few works are carried out on this subject. For this purpose, this study proposes a methodological guide with their respective metacognitive cards to be applied by the teacher to his students, as well as a workbook for the student, which details step by step the topics to be developed in the subject of Methodology of Intellectual Work, with their respective resources and schedule of academic activities of the subject.

The teaching staff of the university uses the Moodle platform as a technological means to strengthen the students' metacognitive skills through activities aimed at attention, memory, language, thinking, and comprehension.

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