Evaluation of the learning process of informational competencies in university students

Evaluación del proceso de aprendizaje de la competencia informativa en estudiantes universitarios

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Keywords
Information literacy; higher education; motivation; performance level

ABSTRACT

This article aims to present the results of a study on the learning process of informational competence in the Universidad José Vasconcelos, Oaxaca, Mexico. From a qualitative research approach, semi-structured interviews, and requests for drawings were applied, and non-participant observation of six students' information search practices was carried out. The findings made it possible to identify quantitative and qualitative changes in the declarative, procedural and attitudinal components of the competence, which differentiate three levels of performance: low, medium, and high. The critical element to understand the competence learning process is in its attitudinal component since this determines the amount and type of declarative knowledge, as well as the procedures that the student is willing to deploy in a coordinated way to search, evaluate and use the information to achieve your academic goals.

Palabras clave
Alfabetización informacional; educación superior; motivación; nivel de desempeño

RESUMEN

El objetivo de este artículo es presentar los resultados de un estudio sobre el proceso de aprendizaje de la competencia informativa en la Universidad José Vasconcelos, Oaxaca, México. Desde un enfoque de investigación cualitativo, se aplicaron entrevistas semiestructuradas y solicitudes de dibujos, y se realizó la observación no participante de las prácticas de búsqueda de información de seis estudiantes. Como parte de los hallazgos se identifican cambios cuantitativos y cualitativos en los componentes declarativo, procedimental y actitudinal de la competencia, los cuales diferencian tres niveles de desempeño: bajo, medio y alto. Se concluye que el elemento clave para comprender el proceso de aprendizaje de la competencia se encuentra en su componente actitudinal, pues este determina la cantidad y el tipo de conocimientos declarativos, así como los procedimientos que el estudiante está dispuesto a desplegar de manera coordinada para buscar, evaluar y usar información a fin de lograr sus metas académicas.

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INTRODUCTION

Upon entering university, students gradually integrate into a culture of social practices that will demand the appropriation of norms, values, strategies and technical terms to deal with information sources, which need to be diverse, exhaustive and reliable (Lankshear and Knobel, 2012). This new enculturation process confronts them with new conflicts in the face of requirements such as the type of information sources that are considered relevant to their academic program, the relevant authors in a given area of knowledge, the valid formats for organizing and communicating the findings of the search, or the appropriate way to present and support their own ideas (Head and Eisenberg, 2009, 2010 and 2013).

This has motivated the development of evaluative research aimed at studying the learning outcomes of information management skills, as well as their relationship with learning environments and educational programs designed for this purpose (Lindauer, 2006). According to Lau and Cortés (2009), due to the influence of Anglo-Saxon countries, most studies are based on the concept of information literacy, which encompasses the teaching and learning of skills to search for, evaluate, use and create information effectively, creatively and ethically (Unesco, 2005). However, since the development of competency-based education models, a term of growing use is information competence, which refers to the student's performance in the search for and processing of information, based on the interrelation of their knowledge, skills and attitudes (Pérez, 2013).

Based on the literature review on the assessment of information literacy or information competence in university students, it was identified that librarianship dominates this area of research. As Lau and Cortés (2009) point out, the concept of literacy considered by these investigations assumes the information user as an individual without competencies who needs to be taught a set of universal skills from "zero", hence the investigations highlight the work of the librarian in the design of formative actions to teach the skills of access and use of information resources and services, with a passive participation of students (Junisbai, Lowe, & Tagge, 2016; Petrucco & Ferranti, 2017).

In line with the above, there is a tendency to apply studies on diagnostic assessment and summative assessment with a quantitative approach using questionnaires on self-perception of skills (De Meulemeester, Buysse, & Peleman, 2018; Nierenberg & Fjeldbu, 2015) or standardized tests (Gross & Latham, 2012; Haglund & Herron, 2008; Rosman, Mayer, & Krampen, 2015). Consequently, the main interest of those researching on librarianship is to assess learning outcomes, rather than to understand the process involved; proof of this are the few studies on formative assessment

reported in the specialized literature (Kathleen and Teague, 2011; Tunon et al., 2015).

In the Ibero-American context, the quantitative perspective also prevails in the study of information literacy. Representative examples of this are studies that focus on the validation of information skills assessment instruments (García, Martínez, & Rodríguez, 2019; Girarte & del Valle, 2020), research that investigates the relationship between self-efficacy, motivation and preferred learning habits of information competence (Pinto, Fernández-Pascual, & García, 2019; Pinto and Guerrero-Quesada, 2017), as well as those studies that evaluate the effectiveness of formative actions on information literacy through pre-test and post-test (Flores-Bueno, Limaymanta and UribeTirado, 2021; Salazar and Ramírez, 2014).

Although it is true that the use of questionnaires or standardized tests makes it possible to identify trends, make comparisons and generalize results, their application at the beginning or end of instruction contributes little to understanding how the cognitive and motivational aspects that account for progress in learning information competency unfold (Bruning and Schraw, 2012). Although some studies start from the authentic assessment approach-for example, the use of rubrics (Carbery and Leahy, 2015; Hoffmann and LaBonte, 2012)-these investigations only allow indirectly verifying the learning process from the analysis of student evidence; thus, their focus of interest is the outcome, not the process.

The study of the information literacy learning process is still a little explored aspect, since a procedural vision of information literacy persists, centered on the concept of universal skills and not on competencies. For this reason, studies that consider the competency approach (Bonilla-Esquivel, 2017; Castañeda-Peña et al., 2010; Marciales, 2012) point out that it is important to conduct research that delves into the relationship between cognitive and motivational aspects in information management.

In response to the above, this work considered as an object of study the learning process of informational competence and assumed its understanding from the strategic learning theory, a perspective that states that learning is a constructive process, goal-oriented and supported by motivational processes, which energize and give meaning to strategic behavior (Hernández, 2017; Schunk, 2012).

In coherence with the strategic learning perspective and based on the contributions of Zabala and Arnau (2014), Perrenoud (2011), Tardif (2008) and Monereo (2005), in this project informational competence is understood as a reflective and strategic process that involves: (a) the analysis of a learning situation-problem on information search and use, (b) the understanding of its scope, and (c) the selection of the most appropriate action scheme - from among those available - to strategically face the demands of information search, evaluation and use, based on its

understanding. The performance scheme mobilizes in an interrelated manner the attitudinal, procedural and declarative components of the competency, resulting in effective interventions (see Table 1).

Table 1. Components of informational competence

Component	Definition
Declarative	It integrates the conceptual knowledge that must be understood in order to treat information critically, ethically and efficiently; these concepts are: authority, value of information, research as inquiry and search as strategic exploration. This component is identified with the knowledge
Procedural	It consists of a set of ordered actions, aimed at achieving an objective, it is the know-how, which indicates which procedures are required to know or use to search, evaluate and use the information
Attitudinal	It includes values, attitudes and norms, aspects that shape principles, behaviors and behavioral patterns. In informational competence, this dimension is integrated by the student's dispositions, attitudes and beliefs, which shape his or her search profile

Source: elaborated with information from ACRL (2016), López-Carrasco (2013) and Zabala and Arnau (2014).

Based on studies on strategic learning (Pozo, Monereo and Castelló, 2001) -particularly studies on novices and experts (Pozo, 2010; Schunk, 2012)-, it is assumed that it is possible to study the learning process of information competence through the quantitative and qualitative changes involved in the transition to higher levels of expertise. These differences are usually classified into two types: 1) quantitative, related to the declarative component of the competence (how much the student knows) and the procedural component (how he/she applies the knowledge); and 2) qualitative, referring to the attitudinal component, which is based on motivational and affective aspects.

In accordance with the above, the general question that guided this research was: what are the quantitative and qualitative changes in the learning process of informational competence in university students? The specific questions that arose are: how do the declarative component, the procedural component and the attitudinal component change in the process of learning information competency, and what is the interrelation between the changes that occur in the components of information competency?

METHODOLOGY

Students create meaning from information-seeking practices in their own terms, and these interpretations happen in sociocultural, sociotemporal, and sociospatial contexts (Cohen, Manion, & Morrison, 2018). For this reason, we opted for a qualitative methodology focused on understanding the learning process of information competence, based on the interpretation of the students' statements about their information seeking experiences and the systematic observation of their activity when solving an information management task in a real scenario (Merriam, 2009).

The context of study is the Universidad José Vasconcelos, a private institution located in the capital of the state of Oaxaca, Mexico. Since the objective was to identify quantitative and qualitative changes in the learning process of information competency, the sample selection was intentional and by convenience (Creswell, 2010): six students from the same academic program and formative period participated, but with different levels of performance in information competency. The fourth semester was considered because in this semester students are familiar with information management practices at the university. Performance levels were identified based on interviews with teachers. Table 2 shows a summary of the selection criteria.

Table 2. Sample selection criteria

				Criteria 3: Gender					
				Woman			Man		
				Criteria 4: Performance level					
				Low	Medium	High	Low	Medium	High
Criteria 1: Academic Program	Bachelor's Degree in Graphic Communication	Criteria 2: Semester	Fourth	E1	E2	E3	E4	E5	E6

Three techniques were considered for data collection, which were applied in the following order and with a space of one week between technique one and techniques two and three.

1) Non-participant observation. Students were asked to videotape their process of solving an information search and use task in the context of the subject Visual Education. The activity consisted in elaborating a PowerPoint presentation, to be presented orally for five minutes, on the topic The Gestalt laws and their application in graphic communication. According to Goetz and LeCompte

(2010), we resorted to the observation of behavioral flows; that is, we recorded the procedures that students deploy when solving an academic task.

2) Semi-structured interview. In this technique, an adaptation of the script proposed by Sonnenwald, Wildemuth and Harmon (2001) was applied to investigate easy and difficult situations of information search at the university. The student was asked to describe the process, the information resources used and the evaluation criteria applied.

3) Drawing request. After the interview, the student was asked to draw a graphic representation of the spaces, tools and information resources he had previously described; he was also encouraged to explain his scheme as he created it. To facilitate the schematization, a template was designed based on the formats proposed by Dalmer (2017) and Savolainen and Kari (2004).

Prior to the application of the instruments, a validation process was conducted through a pilot test. The research design was deployed in April 2020, when face-to-face classes had already migrated to the virtual modality due to the covid-19 pandemic. Given this situation, the following technological resources were used to collect the data: in the video recording, the students were asked to record their actions on screen using the free and open source application OBS (Open Broadcaster Software), for the interviews the Zoom program was used and in the elaboration of the drawings the students used the PowerPoint program. The data were analyzed using the qualitative (Schreier, 2012) and quantitative (Krippendorff, 2004) content analysis (CA) techniques.

RESULTS

The following lines show the findings grouped according to each of the components of informational competence.

Declarative component

Based on the analysis of the drawings made by the students, information search trajectories were schematized to compare the quantity and variety of spaces, tools and information resources used in their academic tasks (see Figure 1). In addition, these trajectories show the students' favorite information resources, those they use the most. When comparing these diagrams with the interview statements, it was identified that there is a relationship between the concept that students have about the information search process and the evaluation criteria they apply, as well as between the tools and information resources they use.

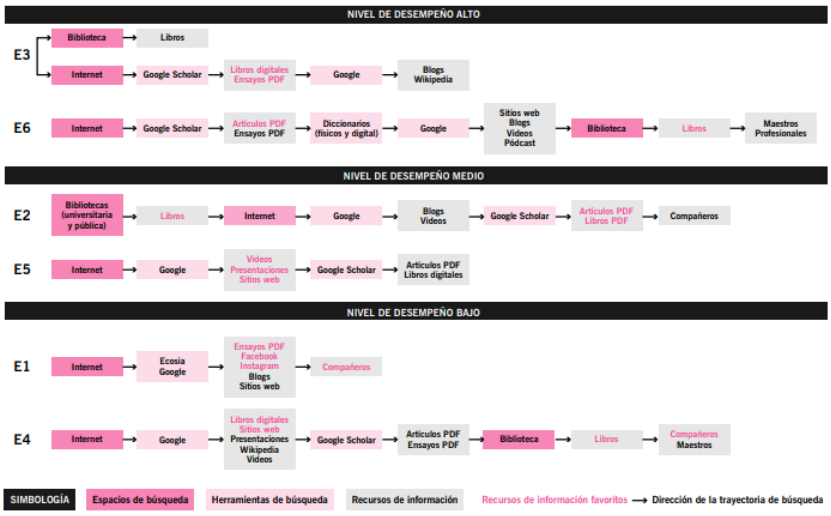

Figure 1. Information search trajectories.

For students with a high performance level, the search process involves analyzing and understanding the information, so they apply selection criteria such as specificity, thematic fit and reliability, aspects that direct their search process towards mainly academic resources, e.g., books, articles and essays:

> E3: I needed truthful information [...] and that it was supported by something. So we had to look for certain essays, but more in the educational field, not so much simply researching on a platform that appeared to us, but more in depth [...]. There are some [essays] that do need references from other more recognized authors, but there are times when that is not the case. Then the essay is just about the person who is speaking and needs certain references, but not so many. So that's when I say, "Well, he mentions them, but he doesn't go into comparing that information with that of other recognized authors."

Students with medium performance level are characterized by incorporating the Google Scholar tool in their search process, in addition to applying basic information evaluation criteria such as reliability or thematic fit. However, like students with a low performance level, they still privilege the use of non-academic resources:

> E2: The truth is, at first glance I rely a lot on the design because there are blogs that you find and that have red and green letters, and no, I automatically get out!!!, because to begin with it is not for the eye [...]. Then I scroll down, I read the information and depending on whether they put the sources, where they got the information from, I go to their sources to see if they are reliable.

What the medium and low performance levels agree on is that they conceive search as a process of fast and efficient information gathering in resources that provide synthesized and timely content; for example, blogs, Wikipedia, online presentations and YouTube videos:

> E4: I use these media because of the ease they provide, because of the efficiency, faster [...]. There were many articles that were very concrete and others that went round and round; then, I selected the most digestible ones.

> E1: First I read it well, and then I selected the parts I thought were the most digestible. I would select one part, put another part and then I would add information from another page to complement it.

Procedural component

In this study it was important to make a contrast between what the student says and what he/she does. Therefore, the analysis of the procedures performed when facing an information search task favored the identification of consistencies or inconsistencies between what is stated about an information search trajectory and what occurs in practice. The systematic observation of the students' video recordings made it possible to analyze and compare the percentage of time spent on reading, the amount and type of information resources used, as well as the processing of the selected information.

As shown in Table 3, in the search and selection of content all students apply the scanning reading strategy, which consists of quickly reviewing the content of the resource consulted. During this review, headlines, words or statements in bold are considered anchor points to stop scanning and perform a detailed reading of the content. In contrast, the percentage of content reading is higher in the case of students with a high performance level; with this strategy, the intention is to understand the content in order to later make paraphrases or arguments.

Table 3. Percentage of time spent on reading and scanning content

Issues observed	Low performance level		Medium performance level		High performance level	
	E1	E4	E2	E5	E3	E6
Percentage of content readership	6.8%	13.5%	9.0%	9.6%	34%	12.6%
Percentage of content scanning	6.6%	7.6%	4.0%	3.5%	8.2%	10.2%

Students at the low performance level are characterized by spending less time reading content, a situation that is related to the perception they have of the search for information as a gathering process. On the other hand, students associated with the medium performance level showed a slight increase in reading time, which is coherent with the way in which they process information, since in addition to copying and pasting content, they make some paraphrases.

The percentages of content reading are coherent with the type of information processing; thus -as identified in the interviews-, at the high performance level, the intention to make paraphrases and arguments is clear, while at the low performance level, the effort is concentrated on copying and pasting information (see Table 4). Regarding the medium performance level, the difference with the lower level is that students incorporate some paraphrases, although the collection of pieces of information still predominates. It is worth noting that students at the high performance level also copy and paste, but in general there is an intention to make an effort to understand the contents. It is possible that the prevalence of the practice of copying and pasting in all levels is due to the type of activity requested, since the elaboration of slides implies mainly the synthesis of information.

Table 4. Number of paraphrases, arguments and information copied and pasted

Issues observed	**Low performance level**		**Medium performance level**		**High performance level**	
	E1	**E4**	**E2**	**E5**	**E3**	**E6**
Amount of paraphrases	0	0	2	4	7	9
Number of arguments	0	0	0	0	0	2
Amount of information copied and pasted	10	15	6	6	7	1

With the intention of contrasting the type of information resources between performance levels, Table 5 allows visualizing the amount of academic and non-academic information resources used, as well as the amount of discarded resources. What was identified is consistent with what was stated in the interviews: students at the high performance level tend to discriminate information resources, which is associated with a more analytical process in the review of contents, while students at the low level tend to rely on the first results they find, so their discrimination process is lower.

Table 5. Quantity and type of information resources used

Issues observed	Low performance level		Medium performance level		High performance level	
	E1	E4	E2	E5	E3	E6
Academic information resources	0	3	1	0	1	5
Non-academic information resources used	7	3	4	4	4	6
Downloaded information resources	0	4	3	0	3	2

Regarding the information search strategies, based on the interpretations that emerged from the analysis of the videos, the findings of the interviews are confirmed. Students in the high performance level consider consulting a greater quantity and variety of information resources (in search engines such as Google and its academic version), in addition to demonstrating a greater capacity to discriminate information by means of the thematic adjustment criterion. As the level of performance decreases, the information horizon is limited to the use of generic search engines and less consultation of academic resources.

Attitudinal component

For the attitudinal component, the objective was set to understand the types of motivation involved in the information management process (Ryan and Deci, 2000a). It is emphasized that in high-performing students, integrated regulation was intensified. According to Reeve (2010, p. 100), this regulation "constitutes the type of extrinsic motivation with the greatest autonomous validation"; that is, university-level information-seeking values and norms are integrated without conflict with students' preexisting modes of thinking, feeling, and behaving. Thus, rather than seeing the processing of academic information resources as having to be done because it is important in college to meet subject demands, it is posited as a valuable process for the individual that is consistent with his or her way of thinking and acting:

> E6: I have tried to see an application to everything I look for, and when I see a use for it, that is when I feel more qualified for certain areas [...], I feel more eager to search, I feel more interest. I think it is due to giving importance to what I am doing and really seeing a profound use for it, both in the work area and in my growth as a person.

A factor of extrinsic motivation shared by students at all performance levels is incentive motivation. As mentioned by Reeve (2010, p. 85), "an incentive is an environmental event that attracts or repels a person to move toward or away from following a specific course of action." The incentive that all students associate with easy and satisfying search experiences are those where they know that there will be a lot of information available on given topics, which will facilitate the search process:

> E5: Yes, I feel it is easier when there is a lot of information on the topic I am looking for.
>
> E1: In that task I was looking for quite a lot of sources and also images; as the topic is easy to search, there were quite a lot of choices of images and information.

It should be recognized that the differences in extrinsic motivation at the medium and low performance levels are not clear. In general, students at these levels are guided by the external regulation exerted by the teacher or by the duty to obey in order to avoid a negative consequence, such as failing (Ryan and Deci, 2000a):

> E4: A teacher who doesn't explain the class to us is like, "Look it up on the internet, make slides and you explain it." Then it's like, "Well, we'll get information from the Internet and then we'll give it to them".
>
> E5: Sometimes I feel that I don't understand much, I do the homework just to hand it in.

As for intrinsic motivation, there is a subtle difference between the medium and low levels of performance. The low level is characterized by a strong attraction to tasks that respond to their tastes and interests. This is repeated at the medium level, where there is also a recognition of the importance of tasks in their learning:

> E1: There are some tasks that we are left with in which we have to look for some designer we like or something like that, or inspiration for illustrations we want to do, or look for illustrators' processes to make one of our own. I think that in these situations I like it, and I put a little more interest in it.
>
> E2: It seems to me that in first year, in Art History, we did a lot of research, a lot of essays on each period of art, on the currents. Actually, I thought it was quite good because you not only have to know the images, but also the context.

DISCUSSION

From the results, quantitative and qualitative changes were identified among the performance levels of the informational competency (see Table 6). These show that the learning process of this competency is different among students of the same semester. Regarding the interrelation between the components, it was found that motivation plays an important role in the students' willingness to get involved in the process of searching for and processing information; what was stated by the students in the interviews suggests that the type of motivation determines the amount and variety of information tools and resources to be used for the achievement of their academic goals.

Table 6. Quantitative and qualitative changes in the components of information competency

Low performance level	Medium performance level	High performance level
Declarative component		
Knowledge of non-academic tools and resources Ease of reading and concreteness as selection criteria. Gathering approach in the search for information	Begins to include specialized search engines Begins to include criteria such as reliability or thematic fit Collector approach to information search	Knowledge of a greater variety of academic tools and resources. Knowledge of more criteria for evaluation of information Focus on understanding the information
Procedural component		
Lower percentage of content reading Focused on copying and pasting content	Lower percentage of content reading Focused on copying and pasting content	Higher percentage of content reading Increased use of paraphrases and arguments.
Attitudinal component		
Intrinsic motivation External motivation (incentives, teacher's style, avoidance of consequences)	Intrinsic motivation External motivation (incentives, teacher's style, avoidance of consequences)	Integrated motivation Motivation by incentives

Students with medium and low performance levels are characterized by conceiving the search for information as a gathering process, hence they use non-academic tools and resources, apply ease of reading as a selection criterion, and tend to copy and paste content. Regarding the factors that regulate their behavior, it was found that a greater involvement in the information search process is related to learning activities that respond to their tastes and interests; however, it is common to perform superficial searches to comply with the delivery of assignments.

These findings are consistent with other studies. According to Castañeda-Peña et al. (2010), students with an informational collector profile are characterized by having motivations that emerge from duty, so they keep successful practices measured mainly by the grade assigned by the teacher; in addition, since they do not plan their information management process, they tend to collect a large amount of content from few sources and to copy verbatim.

On the other hand, Monereo (2009) identified that students with a passive approach find information accidentally, they direct their efforts to collect it casually to fulfill the task they are performing at that moment. Rodriguez (2018) reached a similar conclusion by pointing out that, in general, the process of university students searching the Internet is deployed in a haphazard manner due to the lack of knowledge about academic spaces and tools; for example, the search is mainly performed in Google (a non-specialized tool that, compared to its academic version, provides excessive and ambiguous information). In the same line, Bonilla-Esquivel (2017) concluded that new students entering the university give preference to the first results yielded by search engines, they orient their information and search needs by the demands and signals of professors.

Regarding the high performance level, the findings are related to the selective searcher, indicated by Monereo (2009), and the verifier profile, identified by Castañeda-Peña et al. (2010). Students with this profile are characterized by being proactive in their search and consider known quality elements to select the information they need. In the present research it was identified that students with high performance apply criteria such as specificity, thematic fit and reliability, which is consistent with the greater self-determination of their extrinsic motivation (Ryan and Deci, 2000b).

When it is clear that the information search process should lead to the analysis and understanding of information to influence their learning and professional training, it is expected that students will direct their efforts to deploy search, evaluation and analysis strategies in mainly academic spaces, tools and resources. The above coincides with the paper by Cázares (2009), who shows evidence that intrinsic motivation is a predictor of effective information search.

Now, if the present study is compared with others that have analyzed information search practices on the Internet (Castañeda Peña et al., 2010; Furi and Balog, 2016; HenríquezCoronel, Andrade and Moreno, 2018; Olivares, 2016), there is agreement that students mainly use the Google search engine and that their search processes tend to be superficial; however, these investigations confront students with simulated tasks, decontextualized from the learning process. At this point, the contribution of our study was to implement observation in a real scenario, in addition to reporting data that would help nuance the students' performance level.

CONCLUSION

Unlike studies that assess informational competence with questionnaires on self-perception of skills or standardized tests, this research opted for a comprehensive and diverse approach that favored the comparison between the students' saying and doing. From the task of searching for information, it was possible to contrast, confirm and expand the data obtained through the interview and the drawing request; however, having considered a sample of students from the same semester and academic program, it is recognized the relevance of continuing the application of the research design in other degrees and in more advanced semesters, in order to identify more clearly the difference between the performance levels considered.

As the results showed, quantitative and qualitative changes in the components of informational competence allow us to account for progress in their learning. From the perspective of strategic learning, the quantitative changes identified in the declarative and procedural components should be interpreted in terms of how strategically they use the knowledge of these components. Thus, students who have internalized and integrated the norms and values related to the search for accessible, diverse, reliable and rigorous information, are aware that information search and processing procedures must be deployed in mainly academic tools and resources, in order to understand and transform information into knowledge, which favors their learning. In contrast, students who still conceptualize the search for information as the collection of synthesized and easy-to-read pieces of information find it sufficient to collect information for synthesis and thus comply with the delivery of tasks; this demonstrates a less strategic character in terms of achieving genuine learning.

Regarding the qualitative changes of the attitudinal component, the students' statements sustain that the activation of knowledge and the deployment of information search and processing procedures are energized and driven by their beliefs and motivations, which presents self-determination as the key element to identify the greater or lesser disposition in their learning process.

Students with low and medium performance levels have a low level of autonomous motivation, which means that their regulation responds mostly to external factors, such as the characteristics of the teachers or the nature of the learning activities. Students with a high performance level, on the other hand, show that regulation tends to be more internal, since effort and commitment respond to the concern to demonstrate congruence between their way of thinking and acting in relation to the strategic search for information.

From the above it can be concluded that the interrelation between the components of information competence should be understood in a hierarchical sense, in which the motivational tendency of the student will determine the type of valuation and reading made of the learning context, resulting in greater or lesser involvement and effort.

Based on what has been mentioned so far, it is recommended that the implementation of information literacy training processes at the university should consider motivational and affective factors, since it is not enough to teach procedural aspects of information search, students must also be involved in stimulating and challenging processes that favor greater autonomy in making decisions about what, how and when to search for information to achieve their academic goals. Finally, the study shows that even in advanced semesters there are students with low performance levels in information competency, hence the need to provide differentiated support to address their areas of improvement.

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