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Learning Strategies and Reasoning Skills of University Students☆

Alaitz Aizpurua*, Izarne Lizaso, and Idoia Iturbe

Universidad del País Vasco/Euskal Herriko Unibertsitatea UPV/EHU, Spain

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ABSTRACT

The present study examined the learning strategies of university students and the differences in their use as a function of their performance on a fluid intelligence test, a scientific reasoning task, and a divergent thinking or creativity task — all of which are key skills involved in knowledge generation, which is one of the principal aims of the European Higher Education Area. We used 150 participants, divided into two groups according to their performance on the tasks. They completed a questionnaire of learning strategies for university students (CEVEAPEU), which assesses learning strategies organized into six subscales (motivational, affective, metacognitive, context-control strategies, information searching strategies, and information processing strategies). Those students with higher fluid and scientific reasoning skills reported a greater use of strategies aimed at context control (including social interaction and resource management), whereas participants with higher scores on the creativity task reported a significantly greater use of metacognitive, motivational, and purely cognitive strategies (information searching and processing). Overall, these results indicate that the use of learning strategies aimed at supporting and controlling information processing contribute to different reasoning skills, and suggest that the encouragement of social interaction and cooperation among university students would promote the development of basic cognitive skills such as creative thinking and problem-solving abilities.

Estrategias de aprendizaje y habilidades de razonamiento de estudiantes universitarios

Palabras clave:
Estrategias de aprendizaje
Estudiantes universitarios
Razonamiento científico
Inteligencia fluida
Pensamiento divergente
Creatividad

RESUMEN

En este estudio se analizan las estrategias de aprendizaje (EA) de estudiantes universitarios y las diferencias en su uso en función del rendimiento en una prueba de inteligencia fluida, una tarea de razonamiento científico y una tarea de pensamiento divergente o creatividad, por estar estas habilidades implicadas en la generación de conocimiento, una competencia clave en el actual Espacio Europeo de Educación Superior. Los 150 participantes se han dividido en dos grupos dependiendo de su rendimiento en las pruebas y han completado el Cuestionario de Evaluación de Estrategias de Aprendizaje en Estudiantes Universitarios (CEVEAPEU), que mide el uso de estrategias de aprendizaje organizadas en seis subescalas (estrategias motivacionales, afectivas, metacognitivas, de control del contexto, de búsqueda y de procesamiento de la información). Los estudiantes con mayores niveles de razonamiento fluido y científico reportan un mayor uso de estrategias de control del contexto (que incluyen la interacción social y el manejo de recursos), mientras que aquellos estudiantes con mayores niveles de creatividad informan de una utilización superior de estrategias metacognitivas y motivacionales, además de las puramente cognitivas (de búsqueda y procesamiento de información). En conjunto, estos resultados ponen de manifiesto que el empleo de

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* Corresponding author.
E-mail address: alaitz.aizpurua@ehu.eus (A. Aizpurua).

diferentes estrategias de apoyo al procesamiento de la información contribuye a distintos tipos de razonamiento y apuntan la necesidad de potenciar la interacción social y la cooperación para la promoción del desarrollo de competencias cognitivas fundamentales, como el pensamiento creativo y la resolución de problemas, entre estudiantes universitarios.

Introduction

In recent years, learning strategies (LS) have been regarded as one of the most fruitful research areas for studying the learning process and the factors that affect this process. The importance of such strategies is evident in the university environment with the introduction of a new concept in which the student is placed at the center of the activities developed in the learning process (Martín, García, Torbay, & Rodríguez, 2008; Marugán, Martín, Catalina, & Román, 2013; Samuelowicz & Bain, 2001). In addition, interest in the scientific analysis of the strategies used by university students also derives from the fact that these strategies promote autonomous, critical, and reflective learning of students (Beltrán, 2003), which are included in the main objectives of the European Higher Education Area (EHEA).

LSs have been given multiple definitions (e.g., Beltrán, 2003; Gargallo, 2006; López-Aguado, 2010; Monereo, 1997). However, as pointed out by Gargallo, Campos, and Almerich (2016), whilst at certain times the emphasis has been placed on the cognitive and metacognitive aspects of the concept, this has been enriched to become more inclusive. Thus, an LS can be defined as "the organized, conscious and intentional set of what the learner does to effectively achieve a learning objective in a given social context and integrating cognitive, meta-cognitive, motivational and behavioral elements" (Gargallo, Suárez-Rodríguez, & Pérez-Pérez, 2009, p. 2). From a theoretical point of view, the LSs are based on the perspective of self-regulated learning ("self-regulated learning", Zimmerman, 1986). This construct is understood as the degree to which individuals participate actively at the cognitive/motivational/behavioral level in their own learning process; that is to say, a self-regulated student or one with a good strategic profile would be able to effectively handle a range of LSs (Gargallo et al., 2016) including: (1) affective-motivational and support elements, which suppose the "will" and therefore willingness and suitable climate for learning, (2) metacognitive, which involve making decisions and evaluating them or "self-regulation" by the student, and (3) cognitive, which involve the "skill" or the management of strategies, skills, and techniques related to information processing (Beltrán, 2003; Gargallo et al., 2009, 2016). In this study we adopted the model developed by Weinstein, Husman, and Dierking (2000), which is composed of the aforementioned "will", "self-regulation" and "skill", and which have been agreed upon by other authors (Gargallo et al., 2016; Monereo, 1997; Yip, 2012).

There are a number of studies that have demonstrated the usefulness of LSs in university students (e.g., Aizpurua, 2017; Gargallo, Almerich, Suárez-Rodríguez, & García-Félix, 2012; Jiménez, García, López-Cepero, & Saavedra, 2018; Ossa & Aedo, 2014), which has a positive effect on academic performance (Castejón, Gilar, & Pérez, 2006; Diseth & Martinsen, 2003; Gargallo et al., 2009; Gil, Bernaras, Elizalde, & Arrieta, 2009; Soares, Guisande, Almeida, & Páramo, 2009; Yip, 2009), particularly when using metacognitive strategies (e.g., Camarero, Martín, & Herrero, 2000; Cano & Justicia, 1993; Gargallo et al., 2012). Similarly, university students employ more strategies to support learning such as context control, metacognitive, or motivational strategies in addition to purely cognitive strategies such as information searching and processing (Aizpurua, 2017; Gargallo et al., 2012, 2016).

Analyzing the use of the LS is important because in addition to assisting in the learning of specific content, it can provide ways for developing intelligence (Carbonero, Román, & Ferrer, 2013). For example, it has been observed that high-skill students (non-university students) report a greater use of LSs than students without high abilities (Marugán, Carbonero, León, & Galán, 2013). However, the relationship between LSs and individual differences in reasoning, intellectual, or creative skills has been scarcely examined in university students. This fact is surprising because, although the educational objective in Higher Education is to acquire the necessary conceptual, procedural, and attitudinal knowledge and expertise to apply this knowledge in different situations, creativity is also fundamental to generate transformation, innovation, and social development (Gutierrez-Braojos, Salmeron-Vilchez, Martin-Romera, & Salmerón, 2013), this being one of the basic skills set out by the EHEA (Martínez & Poveda, 2015). Therefore, the main objective of this work is to analyze the relationship between the use of LSs and cognitive skills related to reasoning and creative thinking. A further objective was to determine the strategic profile of university students by analyzing the LSs they report using.

The skills examined in this study are scientific reasoning, fluid reasoning, and creative thinking. With respect to the latter, we agree with Guilford (1967) who identified several characteristics of creative thinking (fluency, sensitivity to problems, originality, flexibility, and capacity for redefinition) and distinguishes between divergent thinking, which is necessary to generate ideas through the exploration of different possible solutions, and convergent thinking, which is involved in the search for the "correct" or optimal response. Both types of thinking represent different components of human creativity (Guilford, 1967) and correspond to other constructs. Thus, the two-factorial theory of Cattell (1971) relates divergent thinking to fluid intelligence (which includes, among others, processing speed, inductive reasoning, fluency of ideas, and capacity for visual representation). Likewise, divergent thinking coincides with "lateral thinking", implied in the stimulation and creation of new ideas through insight, creativity, and ingenuity (De Bono, 1986). Divergent thinking, therefore, is a necessary component for creativity (Clapham & King, 2010; Elisondo & Donolo, 2016; Hommel, 2012) and is often used to estimate creative potential (Runco, 2014; Runco & Acar, 2012). Moreover, fluid intelligence appears to be a skill closely related to creativity, as seen, for example, in the generation of metaphors (Silvia & Beaty, 2012).

The relationship between cognitive variables such as creativity, scientific thinking, and intelligence appears to be undeniable (Sternberg & O'Hara, 2005). However, the main objective of the present study is to determine the relationship between LSs and these skills. Marugán, Carbonero, et al. (2013) found no connection between intellectual capacity and the use of recall strategies in high ability non-university students, although high-ability students have a higher score in all LSs compared with those of lower ability, whilst Gutierrez-Braojos et al. (2013) observed a positive direct effect of metacognitive strategies on the creativity of university students. Thus, regarding the first objective, students with higher levels of cognitive performance are expected to report a more frequent use of LSs in general (Marugán, Carbonero, et al., 2013) and, in particular, students with a greater capacity for creative thinking should report a greater use of metacognitive strategies (Gutierrez-Braojos et al., 2013). As a further complementary objective, we