Epistemological Beliefs and Metacognitive Strategies in Cuban University Students

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The epistemological beliefs and metacognitive strategies of a sample of university students of Electric Engineering are discussed in this short overview. Significant differences between promoting and non-promoting groups were found regarding both beliefs and strategies. A strong correlation effect was also found between the strategies and beliefs about the structure of knowledge and the ability to learn.

Introduction

Since 1990, the study of the personal epistemology adopted a multidimensional perspective when it was introduced the idea of a system of epistemological beliefs (EB), or beliefs about the nature of knowledge and learning (Schommer, 1990). Personal epistemology was conceived as a system of multiple, more or less independent beliefs: a) the stability of knowledge, ranging from tentative to unchanging; b) the structure of knowledge, ranging from isolated bits to integrated concepts; c) the source of knowledge, ranging from handed down by authority to gleaned from observation and reason; d) the speed of learning, ranging from quick learning to gradual; and e) the control of learning, ranging from fixed at birth to live-long improvable.

Nowadays, these EB are known to play an important role in learning (Hofer and Pintrich, 1997; Schommer-Aikins, 2004; Metallidou, 2013; Sajovi et al, 2013). Several studies support that EB can predict the academic performance. In Cuba, studies have targeted the connection of personal epistemology to performance in specialized domains like Physics (Morell and Manzano, 2010) and Mathematics (Vizcaíno et al, 2015).

Metacognitive strategies (ME) are referred to those actions the subject performs before, during and after the learning process in order to optimize the execution of specific learning tasks. In general, the effect of the ME in learning seems to be significant, even though the reports can be controversial (Mason, 1994; Zusho and Pintrich, 2003)

In Morell and Manzano, 2019, the hypotheses of the study are: (H1) The EB differs between promoting and non-promoting groups of Engineering students; (H2) The use of ME differs between promoting and non-promoting groups; (H3) There are meaningful relations between EB and ME.

Participants

This study included 119 first-year junior students, about 70% of the total first year students, from the specialty of Electric Engineering at the Technical University of Havana (CUJAE). Age range was 18-22 years (M = 19.6; St. Dev. = 1.01). Boys accounted for 77.3% of the sample, and girls for 22.7%. All classrooms were approximately equally represented.

	QL	SK	FA	KHA
GPA	r=−0.09	r=−0.13	r=0.12	r=−0.38**
	p=0.523	p=0.357	p=0.400	p=0.006

Table 1: Pearson coefficient r and its significance p between the GPA and belief dimensions. QL: Quick Learning; SK: Simple Knowledge; FA: Fixed Ability; KHA: Knowledge handed down by Authority.

Materials and Procedure

EB were measured using the Epistemological Questionnaire (EQ) designed by (Schommer, 1990) and the ME the State Metacognitive Inventory (SMI) (O'Neil and Abedi, 1996). The individual academic achievement was acquired by collection of scores, identifying the students who passed to the next academic year (promoting group) and those who didn't (non-promoting group). The fractions were respectively 61% and 39% of the sample. For students in the promoting group a Great Point Average (GPA) was also calculated. The identified pending subgroup, within the promoting group, was about 28% of the total sample.

Results

EB and ME in promoting and non-promoting groups

Through factor analysis, using the 12 subsets established in the EQ, a factorial structure was generated for the EB. These are: Speed of Knowledge (naive form: Quick Learning), Structure of Knowledge (naive form: Simple Knowledge), Learning Ability (naive form: Fixed Ability) and Source of Knowledge (naive form: Knowledge handed down by Authority).

We evaluated the contrast between students in promoting and not-promoting groups, regarding the EB. The belief in the structure of knowledge is more sophisticated in promoting students than in the non-promoting group ($t = 2.15$, $p < .03$). That is, students that did not pass to the next year believes more in simple knowledge, while students that passed believe more that knowledge is rather complex.

We also looked at Pearson correlations between GPA and the EB in the promoting group. These results are shown in Table 1. A significant correlation appears in the belief on the source of knowledge. In this way, the less the students believe in knowledge as handed down by authority, the better GPA they earned.

Contrasts between the groups were also encountered regarding the ME. It was found that the employment of self-checking is significantly higher in the promoting group compared to the not-promoting ($t = 3.02$, $p < .003$). Moreover, the results show significant difference regarding the employment of self-checking within the promoting group, i.e. between pending and non-pending ($t = 2.61$, $p < .01$). For these two subgroups, planning employment also leads to a significant contrast ($t = 2.32, p < .03$). That is, students promoting with pending matters uses planning and self-checking significantly less than promoting students without pending matters.

Particular relations between ME and EB

A correlation analysis was conducted relating the belief dimensions to the strategy categories, finding a number of significant Pearson values. Results are shown in Table 2. As can be seen, the less the students believe in simple knowledge, the more self-checking, planning and awareness they use in their metacognitive activity. Furthermore, the less the students believe in fixed ability to learn, the more self-checking and cognitive strategies they display.

	QL	SK	FA	KHA
S	$+0.03$	-0.53^*	-0.32^*	$+0.10$
CS	$+0.07$	-0.04	-0.23^*	$+0.12$
P	-0.19	-0.35^*	-0.09	-0.03
A	-0.08	-0.32^*	-0.07	-0.02

Table 2: Pearson coefficients of correlation analysis between categories of metacognitive strategies and dimensions of epistemological beliefs. S: Self-checking; CS: Cognitive Strategy; P: Planning; A: Awareness. * $p < 0.05$.

Conclusions

Metacognition and personal epistemology were studied through quantitative variables, as well as their relation with the academic achievement, in a sample of Engineering students from a typical low-achievement context. The EB showed a four-factors structure. Significant correlations were encountered between the beliefs in structure and source of knowledge and the strategies of planning and self-checking. In turn, all the four constructs were shown to be significantly connected to the academic achievement. In summary, a better academic performance was linked to better employment of planning and self-checking strategies, as well as to the belief in knowledge as a complex process, derived from reason rather than authority. This study contributes to frame a low-achievement scenario within a learning model centered in the subject, where students' beliefs and self-monitoring abilities play an essential role.

Notes

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