Mingling students' cognitive abilities and learning strategies to transform CALL

Efi Nisiforou[1] and Antigoni Parmaxi[2]

Abstract. Language researchers have identified a number of elements related to language performance. One of these factors is individual attributes of the language learners or their cognitive ability. In the fall semester 2015, 18 undergraduates of Greek for academic purposes language course of a public university in Cyprus participated in the study. This research work attempts to investigate the relationship between students' Field Dependence-Independence (FDI) cognitive ability and learning strategies within a Computer-Assisted Language Learning (CALL) environment. Students FDI cognitive style was measured on their performance on the Hidden Figures Test (HFT) psychometric tool and classified into Field-Dependent (FD), Field-Mixed or Neutral (FM/FN), and Field-Independent (FI) learners. Statistics and mainly qualitative analyses were used to interpret the data. With the end goal of understanding how learners' FDI cognitive ability intersects in learning within a CALL environment, the article concludes with some directions for further areas of research.

Keywords: FDI cognitive abilities, learning strategies, CALL activities, higher education.

1. Introduction

There are many aspects to be considered when designing and developing learning environments – physical or digital. The examination of the relationship between individual differences in cognitive styles and learning strategies is one potential area of study that can inform the needs of potential users of these environments and consequently allow for more personalized materials and environments to be developed. Leyu (2001) noted that by taking the cognitive style of language learners' into account,

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the instructor could elucidate essential information on learners' characteristics related to the successful learning of a foreign language and consequently relate instructional decisions and teaching methods to learners' individual differences.

As mentioned by Nisiforou and Laghos (2013), "[FDI] is among the most broadly studied of the variety of cognitive style dimensions appearing in the literature (Dragon, 2009)" (p. 81). According to Witkin and his colleagues, the FD and FI dimensions can respond to the different kinds of learning and teaching methods, and they can describe two different ways of processing information (Witkin, Moore, Goodenough, & Cox, 1977). Consequently, the FI learner tends to attain the best success in classroom language learning, in contrary to the FD individual (Chapelle & Heift, 2009). Previous research reported the tendency of FD people to adopt a holistic approach to learning, while FIs revoke the information more analytically (Tinajero, Castelo, Guisande, & Páramo, 2011).

This study consists part of an ongoing project which aims to investigate the relationship between students' FDI cognitive ability and learning strategies within a CALL environment. Hence, the current work attempts to identify students' FDI cognitive ability and learning strategies on a set of language activities. Therefore, the following research question is addressed: what learning strategies do different cognitive groups of learners' exhibit while interacting with a range of language learning environments?

2. Method

2.1. Participants

In Fall semester 2015, 18 undergraduates of Greek for academic purposes language course of a public university in Cyprus participated in the study during the 13-week session of their in-classroom instruction. Four participants were excluded from the sample due to non-completion of the HFT psychometric test. The learners' ages range from 19 to 34 years and were recruited from three disciplines; engineering, agricultural studies, and multimedia.

2.2. Research design

The research design was constructed on the basis of the Task-Based Instruction (TBI) methodological approach. TBI uses tasks or stand-alone activities which

require comprehending, producing, manipulating or interacting in the target language (Nunan, 1999).

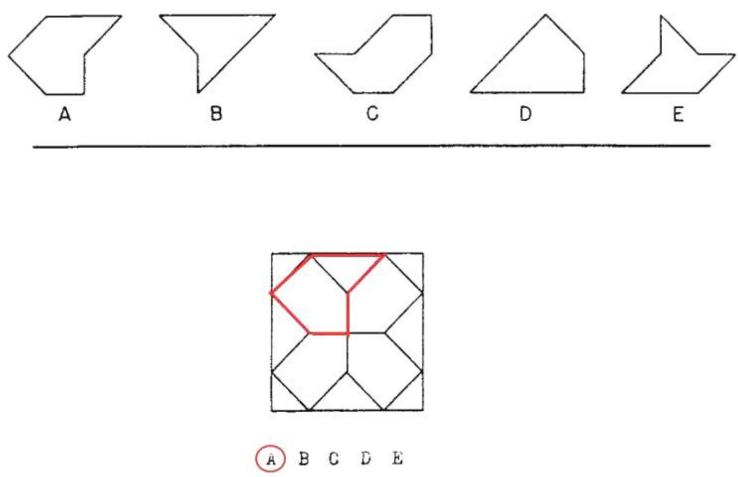
2.3. Materials and procedure

The research was conducted in two parts on an individual basis and took place in the classroom. The HFT was administered before the beginning of the classes.

2.3.1. Psychometric test

The participants were initially categorized by their FDI cognitive style (FD, FN, and FI) on their performance in the HFT (Ekstrom, French, Harman, & Dermen, 1976). The HFT is a psychometric tool that measures the level of an individual's field dependency. It consists of 32 questions, and scores ranged from 1 to 32 (with a maximum of 32 points achievable) on a total completion of 24 minutes. The test presents five simple figures and requests learners to find out which of the five is embedded – with the same size and orientation – in each of the 32 complex patterns (see Figure 1). The testing activity involved in the HFT is a reliable and widely-used approach for determining FDI cognitive dimensions.

Figure 1. HFT task (Ekstrom et al., 1976)[3]



3. The task is to identify which one of the five simpler figures is embedded in the more complex figure. The correct response is the circled letter 'A'.

2.3.2. Learning activities

Students were enrolled in a Greek for academic purposes course which aimed at enhancing their ability to produce language (both oral and written) at an academic level. Throughout this course, students were requested to complete four tasks associated with the four skills:

- Writing: students were tasked to study an academic manuscript and compile it in a short text that can be incorporated in their dissertation.
- Reading comprehension: students were tasked to read an excerpt from an academic manuscript and respond to comprehension questions.
- Speaking: students were tasked to present an academic manuscript related to their dissertation.
- Listening comprehension: students were tasked to listen to an academic lecture and summarize its major points of interest.

Students were requested to elaborate on the process and strategy adopted for completing each of the tasks above, resulting in a list of adopted strategies employed for completing each task. This list consisted of the dataset for capturing students' learning strategies.

3. Results

3.1. Hidden Figures Test

Participants' level of field dependency was measured with the use of the HFT (Nisiforou & Laghos, 2013, 2015). Individuals who scored 10 or below were categorized as FD, those who ranked from 11 to 16 were classified as FN and those who achieved a score of 17 or higher as FI. Participants were classified into their cognitive group as illustrated in Figure 2. The testing activity involved in the HFT is a reliable and widely used approach for determining FDI cognitive dimension. Reliability of the internal consistency of the psychometric test has been validated using Cronbach's alpha coefficient, which is a widely-used index of test reliability. The closer the score is to +1.00, the higher the reliability. In this research study, the

Cronbach's alpha for the HFT was 0.878 (Cronbach, 1977), indicating that items in the psychometric test are correlated to each other.

Figure 2. Classification and distribution of subjects according to the FDI dimension (N=14)

3.2. Learning activities and strategies

The dataset that consisted of students' learning strategies (see section 2.3.2) was imported into the NVivo qualitative data analysis software version 11. Students' responses were clustered into codes by virtue of thematic coding. The iterative coding approach and the subsequent code saturation elicited a total of 4 main thematic topics which were classified under the four given learning tasks. Figure 3 reflects the thematic categorization of students' learning strategies.

Figure 3. Students' learning strategies followed for listening comprehension, reading comprehension, presentation skills and production of written text

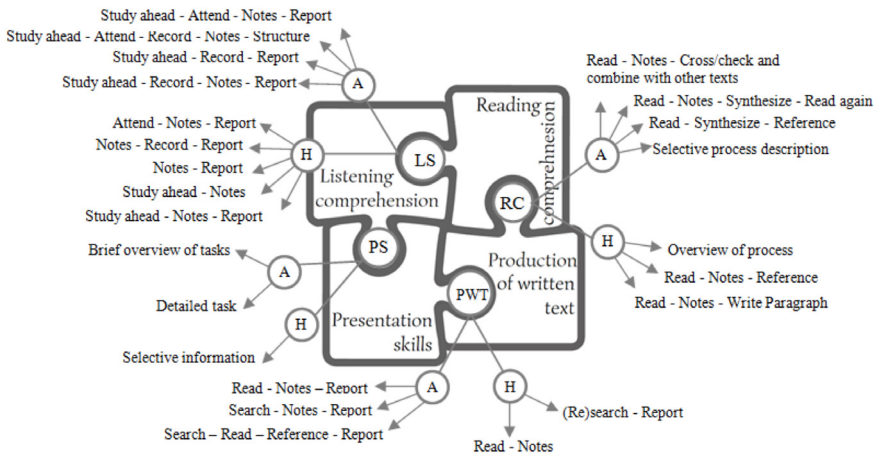


Table 1 demonstrates participants' learning strategies employed for the accomplishment of the four learning tasks by the cognitive group they belong to. Overall, learners' of all three cognitive groups followed a more holistic approach in preference to the analytic approach for the completion of the listening comprehension tasks. The common behavior pattern of solving a listening task is inconsistent with the literature only with regards to the FD and FN group of learners. The results on the FI learners contradict previous studies (e.g. Tinajero et al., 2011) and might have occurred because of the small-scale sample size, seeing that the preferences of the students who adopted a certain learning approach opposed to the other were significantly diverged (only one or two participants).

Table 1. Learning strategies followed by the learners for the completion of the four learning tasks

Participants Code	FDI category	Learning Tasks* and Learning Strategy/ Approach**							
		Listening Comprehension (LC)		Reading Comprehension (RC)		Production of Written Text (PWT)		Presentation Skills (PS)	
		AA	HA	AA	HA	AA	HA	AA	HA
P3	FD		✓		✓	✓			✓
P4	FD		✓		✓		✓	✓	
P5	FD		✓	✓			✓	✓	
P9	FD		✓	✓			✓		✓
P14	FD	✓		✓		✓		✓	
P1	FN	✓			✓		✓	✓	
P8	FN		✓	✓			✓	✓	
P10	FN		✓	✓			✓		✓
P12	FN		✓		✓	✓		✓	
P2	FI	✓			✓	✓		✓	
P6	FI	✓			✓		✓		✓
P7	FI		✓	✓		✓			✓
P11	FI		✓	✓			✓		✓
P13	FI		✓	✓		✓		✓	

Notes:
* Listening Comprehension (LC), Reading Comprehension (RC), Production of Written Text (PWT), Presentation Skills (PS); **Analytic approach (AA), Holistic approach (HA)

As for the reading comprehension task, learners applied their analytical skills by extracting detail from its surrounding context. The production of written texts exemplified FDs' and FNs' holistic mode of thought, whereas, strategies adopted by the FNs yielded their ability to analyze info structurally, thus demonstrating their analytic way of thinking. Finally, the speaking ability task revealed individuals' presentation skills. Specifically, those who fall between the FD and FN cognitive dimension revealed a common learning behavior by choosing the analytic pathway, one that identifies the parts of a task and breaks it down into

smaller sub-tasks. On the other hand, FIs pursued a holistic mode of thought by seeing each task as a whole and not being able to break it down into smaller parts.

4. Discussion and conclusion

This work has made progress toward the goal of better understanding the link between individual differences and use of learning activities within a CALL environment. Previous research reported that FD people have a holistic approach to learning, while FIs revoke the information more analytically (Tinajero et al., 2011). The current study found that the capacity to spontaneously shift back and forth between analytic and holistic modes of thought differs according to the nature of the learning task the learner is engaged with.

The data provided additional evidence that more work is needed to provide instructional design principles for the development of learning environments and materials that support different cognitive ability language learners. Awareness of cognitive style may be greatly beneficial for teachers and instructional designers, as they can inform instructional decisions and teaching methods. Future studies of learning strategy usage hold potential for matching learners with appropriate instructions and provide a particularly challenging application for this line of research.

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