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Examination of self-regulated learning strategies in programming languages courses

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Abstract

The purpose of current research is to determine the levels students studying at Computer Education and Instructional Technologies Department use of SRL strategies in Programming Languages courses and also to exhibit the relationship between students' level of using SRL strategies and their course achievement levels. The research is a qualitative research in the descriptive form. The study sample consists of 57 pre-service teachers studying in the Department of Computer Education and Instructional Technologies at Faculty of Education, Ahi Evran University. In this research, employed data gathering tools are Motivation and Learning Strategies Scale and Programming Languages course achievement test. The results of the study demonstrated that for the students studying Programming Languages course, levels of SRL strategies are on average level. Moreover, there is a significant relationship between the pre-service teachers' course achievement levels and task value, self-efficacy, test anxiety levels.

Keywords: Computer programming skills, self-regulated learning, course achievement;

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1. Introduction

Computer programming, a constituent of computer education, is considered to be an essential basic skill in all computer-relevant fields. This skill calls for complex cognitive skills. In departments such as computer programming, computer engineering and computer teaching, instructors experience a set of hardships in teaching concepts related to algorithm and programming and instructing algorithm preparation and programming [1, 2]. In the process of comprehending programming complex mental skills such as planning, reasoning, problem-solving and analytic thinking play vital role. Problem solving skills likewise entail reasoning and analytic thinking skills essential to analyze a given problem scenario [3, 4]. Recent researches focus on the fact that in the attainment of such skills to individuals, SRL plays a significant function [5, 6, 7, 8].

Self-Regulated Learning (SRL) of which originating point is linked to investigating the reasons accounting for the failures of unsuccessful students has lately turned into a substantial discussion concept in the field of education [9]. SRL is described as the learning process in which a student systematically directs his/her own thoughts, emotions and behaviors towards his/her own goals [10]. SRL necessitates active participation of the person; however this participation should not be limited to behavioral dimension but cover metacognitive and motivational dimensions equally. Pintrich [11] has examined SRL strategies within two group namely motivation strategies, and learning strategies and demonstrated subdimensions for each group. Those individuals capable of using these strategies to the purpose and in effect have been defined as self-regulated learners.

Self-regulated learner is described as an individual who regulates in a controlled manner his/her own cognition, motivation level and behavior to reach a preset objective [12]. Self-regulated learners select the learning environments that offer them the most favorable setting for behavioral learning and manage time effectively, make plans while they reach metacognitive profits, set challenging but attainable targets, stick to the strategies to reach their objectives and make self-evaluations. In terms of motivation they possess high levels of self-efficacy belief, they connect the results to meaningful reasons and attribute great value to the task they accomplish [13]. Within that framework it is considered that detecting self-regulated learning strategies deployed in higher-education programming language courses and identifying the levels these strategies are used by students and uncovering the relationship between these levels and students' achievement levels in this course shall be aidful in providing significant insights in the teaching of programming skills.

The purpose of current research is to determine the levels students studying at Computer Education and Instructional Technologies (CEIT) Department use SRL strategies in Programming Languages (PL) courses and also to exhibit the relationship between students' level of using SRL strategies and their course achievement levels. Within the framework of this overall objective, below given questions have been sought for answers:

a) What are the levels of intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance and test anxiety strategies for the students studying PL course in CEIT Department?

b) What are the levels of rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time and study environment management, effort regulation, peer learning and help seeking strategies for the students studying PL course in CEIT Department?

c) Is there a relationship between the levels of SRL strategies students studying PL course in CEIT Department use and their achievement levels in Programming Languages courses?

2. Method

It is a descriptive study aiming to reveal an existing situation [14]. The study sample consists of 57 pre-service teachers studying in their 2nd and 3rd years in the CEIT Department of Education Faculty at Ahi Evran University.

In this research, employed data gathering tools are Motivation and Learning Strategies Scale [15] and PL course achievement test. Motivation and Learning Strategies Scale (MLSS) has been used to determine students' levels of using SRL strategies in PL courses. MLSS has been originally developed by Pintrich, Smith, Garcia and McKeachie [16] under the name "Motivated Strategies for Learning Questionnaire" and adapted into Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel [15]. The scale consists of two main parts as "motivation scale" comprising of 6 factors and "learning strategies scale" comprising of 9 factors. The scores that can be obtained respectively from each of these sub factors can be separately used to meet the practitioner's usage needs [17]. The whole duration for this seven-graded Likert scale varying between choices "Definitely wrong for me" (1) and "Definitely right for me" (7) is around 20-30 minutes. Students select their own agreement levels in the evaluation form corresponding to a statement on the scale. The findings related to reliability studies conducted by Büyüköztürk et al. [15] within two different universities amidst 852 students from different departments; for the sub factors of motivation scale Cronbach alpha values vary between 0.86 and 0.52, for the sub factors of learning strategies scale these values change between 0.75 and 0.41. In this research, Cronbach alpha (α) reliability coefficients of the sub factors belonging of the scale are as demonstrated in Table 1.

Table 1. Cronbach alpha values of the sub factors of Motivation and Learning Strategies Scale

	Sub factors	α
Motivation scale	Intrinsic goal orientation	,73
	Extrinsic goal orientation	,63
	Task value	,90
	Control of learning beliefs	,75
	Self-efficacy for learning and performance	,92
	Test anxiety	,83

	Sub factors	α
Learning strategies scale	Rehearsal	,67
	Elaboration	,73
	Organization	,77
	Critical thinking	,76
	Metacognitive self-regulation	,86
	Time and study environment management	,74
	Effort regulation	,66
	Peer learning	,75
	Help seeking	,54

PL course achievement test has been employed to detect students' course achievement levels. This test has been formed on the basis of the contexts of Programming Languages I and Programming Languages II courses. Achievement test comprises of 10 open-ended questions. To the end of identifying content validity of the test, opinions have been received from 3 field specialists and 1 measurement and evaluation specialist and upon making necessary corrections achievement test has been put into effect.

In current research arithmetic mean, standard deviation and Pearson correlation coefficient have been computed in solving the data pertaining to sub problems. In the interpretation of findings 0,05 significance level has been used.

3. Results

The findings obtained from this research have been respectively analyzed under the titles appropriate to the sub problems investigated in current paper.

In Table 2 score averages of intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance and test anxiety for the students studying PL course in CEIT Department are exhibited.

According to Table 2, for the students studying PL course in CEIT Department, levels of intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance are above average in the direction of "Definitely right for me" whereas the levels of test anxiety are above average in the direction of "Definitely wrong for me". It has also been determined that students' score averages related to their level of using strategies for intrinsic goal orientation is higher than the rest.

Table 2. Score averages of students' sub factors in motivation scale

	Sub factors	N	$\bar{x}$	s
Motivation scale	Intrinsic goal orientation	57	5,41	0,94
	Extrinsic goal orientation		4,79	0,94
	Task value		5,20	1,13
	Control of learning beliefs		5,50	0,81
	Self-efficacy for learning and performance		5,23	1,02
	Test anxiety		3,47	1,40

In Table 3 score averages of rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time and study environment management, effort regulation, peer learning and help seeking for the students studying PL course in CEIT Department are exhibited.

Table 3. Score averages of students' sub factors in learning strategies scale

	Sub factors	N	$\bar{x}$	s
Learning strategies scale	Rehearsal	57	5,14	1,00
	Elaboration		5,23	,86
	Organization		5,22	1,04
	Critical thinking		5,02	,92
	Metacognitive self-regulation		5,14	,87
	Time and study environment management		4,79	1,01
	Effort regulation		4,82	1,04
	Peer learning		4,50	1,22
	Help seeking		4,69	1,01

According to Table 3, for the students studying PL course in CEIT Department, levels of rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time and study environment management, effort regulation, peer learning and help seeking are above average in the direction of "Definitely right for me". It has been identified that students' score averages related to their level of using elaboration strategy is the highest compared to the rest and their level of using peer learning strategy is the lowest in comparison to the other strategies.

In Table 4, Table 5 and Table 6 the relationship between score averages of the levels of SRL strategies students studying PL course in CEIT Department use and their achievement levels in PL

courses have been illustrated. In Table 4 the relationship between levels of inner goal setting, outer goal setting, task value, control belief related to learning, self-efficacy perception and test anxiety and their course achievement levels have been presented. In Table 5 the relationship between levels of rehearsal, elaboration, organization, critical thinking and metacognitive self-regulation and their course achievement levels have been presented. In Table 6 the relationship between levels of time and study environment management, effort regulation, peer learning and help seeking and their course achievement levels have been presented.

Table 4. The relationship between students' score averages pertaining to sub factors in motivation scale and their course achievements

		Intrinsic goal orientation	Extrinsic goal orientation	Task value	Control of learning beliefs	Self-efficacy	Test anxiety
Course achievement	r	,211	,148	,482**	,006	,458**	-,311*
	p	,115	,273	,000	,965	,000	,019
	N						57

** p<0,01 * p<0,05

It is demonstrated in Table 4 that between students' task value and self-efficacy for learning and performance levels and their course achievement levels there is an average level of positive, meaningful relationship (p<0,01). It has also been detected that between students' test anxiety levels and course achievement levels there is an average level of negative, meaningful relationship (p<0,05).

Table 5. The relationship between students' score averages pertaining to sub factors in cognitive and metacognitive strategies scale and their course achievements

		Rehearsal	Elaboration	Organization	Critical thinking	Metacognitive self-regulation
Course achievement	r	-,161	,076	,006	,189	,106
	p	,233	,572	,965	,159	,434
	N					57

Table 6. The relationship between students' score averages pertaining to sub factors in resource management strategies scale and their course achievements

		Time and study environment management	Effort regulation	Peer learning	Help seeking
Course achievement	r	,109	,166	,038	-,164
	p	,418	,218	,779	,224
	N				57

As set forth in Table 5, there is no meaningful relationship between students' cognitive strategies use levels and their course achievements. According to Table 6, there is no meaningful relation between students' resource management strategies use levels and their course achievements.

4. Conclusion

It has been designated that for the students studying PL course in CEIT Department, intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance and test anxiety levels are on average level. It has been put forth that students' level of using intrinsic goal orientation strategies is higher than the other strategy types. Also, it has been seen that in PL courses students' level of using elaboration strategies is higher than the other cognitive strategy types; similarly their level of using cognitive and metacognitive strategies is above using resource management strategies. It has been put forth that students' level of using peer learning strategy is lower than the other types of strategies. Based on these findings it can reasonably be argued that students studying at CEIT Department fail to effectively use SRL strategies in PL courses.

As the relationship between PL course achievement levels of CEIT Department students and their level of using SRL strategies is analyzed it surfaces that there is a meaningful relationship between task value, self-efficacy for learning and performance and test anxiety which are in motivation dimension and their course achievement levels. However it has been detected that between other sub dimensions of SRL and course achievement level there is no connection. This finding is not consistent with relevant literature. Haşlaman and Aşkar [5] explain that while studying computer programming course, assigning value, orienting towards outer goal, goal setting, rehearsal, self-reflection, self-efficacy perception, effort regulation, cooperating with others and time management which collectively compose using SRL strategies explain 71% of students' achievement. It has also been witnessed that other strategies play no significant role in the attainment of success.

It is suggested that SRL strategies students use in Programming Languages courses should be set forth via qualitative researches and activities that allow further use of these strategies should be implemented.

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