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Effect of learning styles on prospective teachers' self-regulated learning skills

Sinem Dincol Ozgur*, Faculty of Education, Hacettepe University, Beytepe, 06800 Ankara, Turkey

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Abstract

The aim of this study was to determine the learning styles of prospective chemistry and science teachers, and to examine the effects of different learning styles on their self-regulated learning skills. The survey method which is one of the quantitative research methods was used in this study. A total of 251 prospective chemistry and science teachers from the Departments of Chemistry and Science Education of three different public universities participated in the study. The Self-Regulated Learning Skills Scale was used to determine the self-regulated learning skills of the prospective teachers, and the 'Maggie McVay Lynch Learning Style Inventory' was used to determine the prospective teachers' learning styles. The results showed that 61.8% of prospective chemistry and science teachers had a visual learning style, followed by a moving or kinaesthetic learning style (19.9%) and an auditory learning style (18.3%). Furthermore, a statistically significant difference was determined in the prospective chemistry and science teachers' lack of self-directedness scores.

Keywords: Learning style, prospective chemistry and science teachers, self-regulated learning.

* ADDRESS FOR CORRESPONDENCE: **Sinem Dincol Ozgur,** Faculty of Education, Hacettepe University, Beytepe, 06800 Ankara, Turkey. *E-mail address:* sinemdincol@hacettepe.edu.tr / Tel.: +90-312-780-5548

1. Introduction

The concept of self-regulation, which is gaining importance in educational research, is defined as a constructive process in which individuals take responsibility for their own education and regulate their learning through the control of their cognition, behaviour and motivation in the process of attaining their goals (Pintrich, 2004; Schunk, 2005; Schunk, Pintrich & Meece, 2008). It is also defined as the degree to which learners actively take part in their own learning processes in concepts of metacognition, motivation and behaviours (Zimmerman, 1989).

When learners need to learn, they need to provide and organise their own learning that reveals the concept of self-regulated learning (SRL) (Altun & Erden, 2006). SRL is a process of learning in which learners actively regulate their behaviours and cognition after going through various self-regulatory processes (Pintrich, 2000). Learners monitor and adjust their learning strategies in SRL processes (Cheng, 2011), and self-regulated students are capable of directing their learning to construct their learning and to regulate their motivation, and thus, are proactive in their efforts to learn (Pintrich, 2000; Zimmerman, 2002).

Models of SRL are considered in two main categories: Motivational beliefs and self-regulation strategies. Self-regulation strategies are defined as the procedures used by individuals in the making of effective decisions or to gain the desired knowledge and skills (Zhang & Sternberg, 2001; Zimmerman, 1989; 1990). These can also be defined as cognitive strategies, and can include actions such as repetition, making sense, recalling and understanding (Pintrich & De Groot, 1990). Learning strategies are the most effective way of using the learning styles that individuals possess (Riding & Rayner, 1998). Motivational beliefs are ideas and beliefs held by individuals related to objects, events, academic performance or cognitive activities (Boekaerts, 2002; Pintrich & De Groot, 1990). Boekaerts (1999) proposes a three-layered general model of SRL. The first inner layer of this model involves the regulation of cognitive strategies or learning styles, and this layer is considered to be very important for describing the quality of learners' self-regulation process. The middle layer involves the use of skills and metacognitive knowledge for direct learning; and the outer layer refers to the relevance of the regulation of the 'self' and 'motivation'.

Emphasising the importance of SRL in the learning process, Boekaerts (1999) states that the learning style of the individual plays a significant role in the formation of self-regulation skills. An effective self-regulation can be realised, when learners can organise their learning for their own purposes in their learning environments (Boekaerts & Niemivirta, 2000). SRL emphasises the relationship between self-regulatory learning skills and learning styles that show the individuals' preferences for learning in learning environments. One of the most important aspects of educational research relates to 'how students learn'. There are differences in 'how we perceive knowledge' and in 'how we process the knowledge we perceive' in learning, as each person perceives knowledge differently and takes it into the mind in different ways. While some may become aware of knowledge through feeling, others may become aware through observation, thought or by doing (McCharthy, 1987; 1990). The differences in learning preferences indicate that students have different learning styles (Felder, 1996), and indeed there are a number of different definitions of learning styles in the literature, although they are usually specific to the individual and demonstrate their learning preferences.

Kolb (1984) defines learning styles as the preferred methods of individuals related to the receiving and processing of knowledge, while Clark (1999) suggests that learning styles refer to the methods employed by students in the use of stimuli and in responding to stimuli in a learning environment. Gregorc (1979) states that learning styles consist of distinctive behaviours that show how an individual learns and adapts what they have learned to the environment; while Riding and Rayner (1998) noted that one's learning style is not limited to individual preferences or the individual appearances of learning activities, as it also includes mental or individual differences. Cornet (1983) categorises learning styles into three categories: Cognitive, affective and physiological. The cognitive dimension

involves the perception, processing, storing and recalling of knowledge; the affective dimension involves the personal traits that are active in issues such as motivation, attention, focus of control, interest, willingness to take risks, responsibility and enjoying social life; and the physiological dimension, on contrary, includes sensory perceptions (visual, audio, kinaesthetic, touching, tasting), environmental properties (light, heat, order of the room, noise and so on) and the necessary food to ensure optimum learning will occur (Cornet, 1983; as cited: Ekici, 2003). McVay Lynch's Learning Styles Inventory, which is used in the present study, contains sensory perceptions (visual, auditory and kinaesthetic) as a sub-dimension of the physiological dimension of Cornet's (1983) classification. According to this inventory, individuals who learn by seeing have a visual learning style, while those who learn by hearing have an auditory learning style and those who learn by doing have a kinaesthetic learning style (McVay Lynch, 2004).

SRL skills and their correlations with variables such as academic achievement, epistemological belief, gender, problem solving and self-efficacy are still being investigated in educational studies (Al Mutawah, Thomas & Khine, 2017; Bono & Bizri, 2014; Bozpolat, 2016; Celik Ercoskun & Kose, 2014; Cheng, 2011; Kadioglu, Uzuntiryaki & Capa Aydin, 2011; Malpass, O'Neil, Harold & Hocevar, 1999; Metallidou, 2012; Pintrich, 1999; Pintrich & De Groot, 1990; Turan & Demirel, 2010), while studies analysing the correlations between learning styles and SRL are limited (Banarjee & Kumar, 2014; Cassidy, 2011; Colak & Altun, 2011; Goodarzi & Mirhashemi, 2013). Cassidy (2011) considers learning styles, academic control beliefs and student self-evaluation as key variables for SRL students, based on the research by Boekaerts (1999). Goodarzi and Mirshashemi (2013) point out that individuals with different learning styles use different SRL strategies, and that researches into learning styles aim to describe the processes that underlie SRL.

1.1. Aim of the study

The aim of this study was to determine the learning styles of prospective chemistry and science teachers and to examine the effect of different learning styles on their SRL skills. To this end, this study addresses the following research questions:

- What are the learning styles of the prospective chemistry and science teachers?
- Are there any statistically significant differences between prospective chemistry and science teachers' SRL skills according to different learning styles?

2. Method

2.1. Research model

In this study, the survey method, which is a quantitative research approach, (Fraenkel & Wallen, 2006) was used to determine the effect of different learning styles on the SRL skills of prospective chemistry and science teachers.

2.2. Study group

This study was conducted with a total of 251 prospective chemistry and science teachers from the Departments of Chemistry and Science Education, Faculty of Education in three different public universities in Turkey. The participants were aged between 18 and 23 years, and their demographic properties are presented in Table 1.

Table 1. Demographic properties of study group

		Number	Percentage
Department	Chemistry	70	27.9
	Science	181	72.1
	Total	251	100

	First grade	32	12.7
	Second grade	42	16.7
Class/grade	Third grade	86	34.3
	Fourth grade	91	36.3
	Total	251	100
	Male	74	29.5
Gender	Female	177	70.5
	Total	251	100

2.3. Data collection tools

In the current study, 'The Maggie McVay Lynch Learning Style Inventory' and 'The Self-Regulated Learning Skills Scale (SRLSS)' were used as the data collection tools.

- *The Maggie McVay Lynch Learning Style Inventory*, which was developed by McVay Lynch (2004) and adapted into Turkish by Daghan and Akkoyunlu (2011), was used to determine the prospective teachers' learning styles. The adapted inventory consists of 59 items and 3 factors, being 'visual learning style (21 items), auditory learning style (19 items) and moving or kinaesthetic learning style (19 items).' The Cronbach's α value of the inventory is 0.9536 and the standardised Cronbach's α value of the inventory is 0.9542 (Daghan & Akkoyunlu, 2011).
- *The SRLSS*, which was developed by Turan and Demirel (2010), was used to determine the SRL skills of the prospective teachers. The scale is a five-point Likert-type scale comprising 4 factors and 41 items. The factors in the scale are 'motivation and action to learning', 'strategy using and assessment', 'planning and goal setting' and 'lack of self-directedness'. The Cronbach's α reliability coefficients for each factor and for the entire scale are calculated, respectively, as 0.88, 0.91, 0.83, 0.76 and 0.91 (Turan & Demirel, 2010).

2.4. Data analysing

Initially, the missing data were checked and descriptive statistics was compiled. Having tested whether or not the assumptions were met, a multivariate analysis of variance (MANOVA) was conducted.

3. Findings

For the first research question, the learning styles of the prospective chemistry and science teachers were determined, with the mean scores calculated for each group of learning styles. Table 2 presents the distribution of the prospective chemistry and science teachers in terms of their learning styles.

Table 2. Demographic properties of study group

Learning styles	Frequency	Distribution (%)
Visual learning style	155	61.8
Auditory learning style	46	18.3
Moving or kinaesthetic learning style	50	19.9
Total	251	100

For the second research question, the one-way MANOVA indicated that there were significant differences between the prospective chemistry and science teachers' SRLSS scores for motivation and action to learning, planning and goal setting, strategy using and assessment, and lack of self-directedness, based on their different learning styles (Wilks λ (^) = 0.933, $F_{(8,490)}$ = 2.169, p = 0.028, $p < 0.05$). When examining variance analysis tables, it was suggested that a more reliable measure of the alpha level should be determined and the tables should be analysed according to the identified

alpha value (Pallant, 2010). In current research, the alpha value was obtained to be 0.0125 (0.05/4). An examination of Table 3 based on this new alpha value demonstrates that the prospective chemistry and science teachers' lack of self-directedness scores differed significantly according to their learning styles ($p = 0.009$, $p < 0.0125$), while their other factor scores were not influenced by their learning styles ($p > 0.0125$).

Table 3. Tests of between subject effects

Source	Dependent variable	Type III sum of squares	*df*	Meansquare	*F*	*p*	Partial η^2
Group	Motivation and action to learning	19.055	2	9.527	0.414	0.662	0.003
	Planning	87.875	2	43.938	1.536	0.217	0.012
	Strategy using and assessment	79.014	2	39.507	0.315	0.730	0.003
	Lack of self-directedness	250.931	2	125.466	4.791	0.009	0.037

The Tukey test results for the 'Lack of self-directedness' were shown in Table 4. According to Table 4, the difference in the mean score for lack of self-directedness recorded for the visual learning style group ($\bar{X}$ = 22.8452, SD = 4.94) was significantly different to that of the auditory learning style group ($\bar{X}$ = 20.1957, SD = 5.55). There was no statistically significant difference between the mean scores of the moving or kinaesthetic learning style group ($\bar{X}$ = 22.02, SD = 5.23) and the auditory and visual learning style groups.

Table 4. Multiple comparisons

Dependent variable		(I) Group	(J) Group	Mean difference (I – J)	SE	Significance
Lack of self-directedness	Tukey's HSD	Visual learning style	Auditory learning style	2.64	0.85	0.006
			Moving or kinaesthetic learning style	0.82	0.83	0.583
		Auditory learning style	Visual learning style	−2.64	0.85	0.006
			Moving or kinaesthetic learning style	−1.82	1.04	0.191
		Moving or kinaesthetic learning style	Visual learning style	−0.82	0.83	0.583
			Auditory learning style	1.82	1.04	0.191

HSD = honestly significant difference.

4. Discussion and conclusion

The aim in this study was to determine the learning styles of prospective chemistry and science teachers from the Departments of Chemistry and Science Education in three different public universities, and to examine the effects of different learning styles on the SRL skills of the respondents. A total of 251 prospective chemistry and science teachers were included in the study, among which, 61.8% have a visual learning style, 19.9% have a moving or kinaesthetic learning style and 18.3% have an auditory learning style. McVay Lynch found that 60% of the individual population had a visual learning style (McVay Lynch, 2004; as cited Daghan & Akkoyunlu, 2011), and the findings of the present study support this result. Visual learners learn best visually by means of diagrams, charts, graphs, pictures, illustrated textbooks, videos, overhead transparencies, flip charts and handouts. Auditory learners learn best by listening to lectures or to what others have to say; and kinaesthetic learners learn best with hands-on approach (Ldpride, n.d.). The awareness of individuals of their own learning styles helps them to see their strengths and weaknesses, and to regulate their learning accordingly (Gilakjanii & Anhmadi, 2011). Cuaresma (2008) claims that the learning preferences of a learner should be included in learning environments so as to allow all learners to

learn. Determining the learning styles of individuals and providing education in line with this could contribute to effective learning and to the development of positive attitudes towards a subject (Claxton & Murrell, 1987; Felder, 1996; Yilmaz & Dincol Ozgur, 2012).

For the prospective teachers in the present study, having SRL skills is an important factor in their success, and in their ability to aid their students in gaining such skills in the future. SRL skills among those with different learning styles differed only in the factor of 'lack of self-directedness', and no significant differences were found in the factors of 'planning and goal setting', 'motivation and action to learning' or 'strategy using and assessment' among those with different learning styles. Students that lack self-directedness 'may have problems directing their learning process' (Demiroren, Turan & Oztuna, 2016). When the items in the factor of 'lack of self-directedness' were examined, it was found that the items were related to the preferences of the learners in their learning process (items 3, 7, 12, 20, 23, 32 and 39). The items of 'lack of self-directedness' are: 'I wait for other people to tell me what to do in order to learn' (item 3), 'I have difficulties in determining how I should study a particular subject' (item 7), 'I wait for other people to provide me with the important knowledge that I have to learn' (item 12), 'When faced with difficulties in solving a problem, I prefer other people to solve it' (item 20), 'The instructor is primarily responsible for my learning' (item 23), 'I prefer to wait for someone to instruct me as to how to study' (item 32), 'I face problems in identifying how I should start to study' (item 39) (Turan, Demirel & Sayek, 2009).

Boekaerts and Niemivirta (2000) state that effective self-regulation can be developed in learning environments arranged according to the learners' goals. The learning styles of learners play significant roles in the formation of SRL skills (Boekaerts, 1999). Colak and Altun (2011) identified a relationship between the self-regulation skills of university students from various departments of the Faculties of Arts and Sciences and their preferred learning styles in a learning environment. The learning style variable is at the heart of SRL (Cassidy, 2011), which is described as an innate ability and a process (Lee, 2012). The self-regulation skill is a one that can be learnt and developed (Zimmerman, 2002), and so it is important that learning styles, as one of the variables that is influential in the development of skills of self-regulation, should be taken into consideration when designing a learning environment.

This study has analysed how the learning styles of individuals influence their self-regulation skills by making use of Maggie McVay Lynch's Learning Styles Inventory. The present study was conducted with only prospective chemistry and science teachers. Based on the current research, it could be recommended that similar researches may be carried out with university students, who study at other departments, in the future.

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