Research Article

Science Student Teachers' Approaches to Studying*

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Abstract

In this study, science student teachers' approaches to studying was investigated. This is important because as knowing an individual's preferred way for studying can potentially help teachers to design learning environments that is likely to better foster the individual's learning needs. The participants were 381 student teachers on teacher education course during 2016/17 academic year. The Approaches and Study Skills Inventory for Students (ASSIST) was used to collect the data. The analysis of the data revealed that science student teachers' approaches to studies showed statistically significant differences based on their gender, subjects and study years. The findings have important implications for teacher education courses.

Keywords: approaches to studying, student teachers, teacher education, science education

1. INTRODUCTION

Education involves a systematically regulated process carried out in order to prepare individuals to live, to communicate effectively with their surroundings, and to gain attitudes and skills that will benefit them and their environment. (Yiğit, Devecioğlu & Ayvaci, 2002). Psychologists, educators and researchers have raised a lot of arguments for making the definition of education and training, and these debates have been going on for many years. Some learning approaches have become more popular at different times and become more of a topic of interest and debate (Kara & Ozgun- Koca 2004). Learning in the most general sense is a meaning loading process. In recent researches, it has been revealed that students learn using different strategies and methods, that is, they do not learn all the same way (Çolak & Fer 2007). In addition, learning has become a common theme in all countries (Case & Gunstone, 2001), explaining why some learners may be more successful than others.

According to Dunn and Dunn (1986), who have worked extensively on learning approaches and have developed a model for the methods they choose to study, the learning approach of each person is as unique as the individual's fingerprint. A learning approach is the way an individual prefers while learning a new situation, new knowledge, preparing to learn a difficult task, learning, or trying to remember old information. Approaches to study have an important place in individual's lives. When people are aware of their own learning, that is, their approach to learning, they will put this method into practice when performing the learning work. This will make learning easier and, as a result, probably more successful (Biggs, 2001). An approach to studying can also be defined as a differentiation in the purpose and activity when performing a learning task (Entwistle & McCune, 2004).

How pupils perform their learning task and how they are affected by the environment has a decisive influence on learning products (Ekinci, 2009). Learning approaches are recognized as the diversity of activities that can be chosen appropriately for any learning task (Entwistle & McCune, 2004). The way individual prefers to study has attracted an important interest from the researchers in

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education. The question has begun to emerge as the problem of many researchers. In studies in the field have demonstrated that different courses and strategies are being followed by students during studying (Çolak & Fer, 2007). Learning and study approaches determine the way students approach academic tasks (Aslan-Efe & Özmen, 2018; Mattick, Dennis and Bligh, 2004). According to Biggs (1999), while some learners are performing their learning tasks in detail and trying to understand in every dimension, others try to memorize without having to go into details and establish connections between them. That is, some people understand the subjects in their minds and associate them with all their dimensions, while others try to learn only to get good grades. There are three basic approaches to the study of teaching (Entwistle, McCune & Hounsell, 2002; Entwistle & Ramsden, 1983, Marton & Säljö, 1976). These are surface, strategic and deep approaches to studying. The students in the first group (surface approach) work with fear of failure during routine learning and the students in the second group (strategic approach) use space and time effectively to bring their success to the appropriate level and in the third group students internalise learning in order to bring learning to the highest level (Entwistle & McCune, 2004, Mattick, Dennis & Bligh, 2004). The surface approach is an approach that knowledge is provided by the authority, it is unchangeable and definite, learning ability is fixed, and it does not contribute to change and development (Chan, 2003). The surface approach can be defined as accomplishing task as an externally imposed burden. In the surface approach, parts are studied without focusing on the whole, making it difficult to distinguish the principles from the learners. Students who adopt this approach are trying to memorize information (Rowe, 2001). In the surface approach, the primary goal of the students is to overcome the imposed task, which is described as a dysfunctional information gathering that causes the learners to confine learning to the restricted learning process (Enwtsitle, 2000). This approach leads to a situation in which low cognitive activities are used, which leads to very fragmented results from giving the whole thing and its meaning. Therefore, students should be encouraged to adopt the deep approach to studying instead of the surface approach (Biggs, 1999). Individual who adopt a deep approach to study participate actively, meaningfully and appropriately in the learning environment. Students who prefer a deep approach have the ability to concentrate on details, with appropriate readiness, infrastructure, information organization, focus on issues at a high level, revealing meaningful relationships between disjunctive issues (Biggs & Tang, 2011). Rowe (2001) described the deep approach as associating and interpreting previous knowledge with new knowledge, relating reason and results, understanding the rationale of content, and understanding content. The strategic approach includes the acquisition strategy as students are guided to the goals and high grades (Biggs, 1987).

Researchers demonstrate that the differences in learning environments of students are determinative of which studying approach students are more likely to have. In traditional teaching environments where the teacher instruction is prevalent and students are mainly passive recipients, the students tend to learn surface (Dart, Burnett & Purdi, 2000). The learning environment where deep approach to study is aimed students are more likely to be critical, in the centre, active and take on their own learning responsibilities (Pimparyon et al., 2000). Since the teacher is an important element in the learning-teaching environment, it will also affect the students whose course instruction approach the teacher uses, thus affecting the quality and effectiveness of teaching (Ekinci, 2009). Richardson (2011) also suggests that students are an important factor affecting the study approach adopted by the learners of academic environmental perceptions. It is known that students can show different course work approaches according to each lesson and teacher and can affect the teacher and the lesson student in different dimensions (Entwistle & McCune, 2004). The teaching environment, the dimension of assessment, the quality of teaching, i.e. the role of the teacher, has a decisive influence on the course study approach adopted by the individual (Vermetten, Lodewijks & Vermunt, 1999). The way students prefer while studying can be seen as predictor for teachers to design learning environments in order to enhance learning and render the learning experience as an enjoyable activity. This study, therefore, investigated science student teachers studying approaches by trying to answer the following questions:

1. Are there differences in science student teachers' approaches to studying in terms of their gender?
2. Are there differences in science student teachers' approaches to studying in terms of their subject?
3. Are there differences in science student teachers' approaches to studying in terms of their study years (grades) for teacher education course?

2. METHOD

The investigation of the science student teachers' approaches to studying was conducted through a descriptive research method. In descriptive research method, the researcher is able to observe a relatively large target population and make required conclusions about the variables (Ritchie et al., 2013).

2.1. Participant

The participants were 381 (M:113, F:268) science student teachers on teacher education course at Dicle university in Turkey during 2016/2017 academic year.

Table 1. The frequency and percentage of the participants according to their gender, subject and grades

	Gender		**Subject**				**Grade**				
	Male	Female	Biology	Physics	Chemistry	Primary science	1	2	3	4	Graduated
f	113	268	82	36	78	185	75	52	99	87	68
%	27,7	70,3	21,5	9,4	20,5	48,6	27,7	13,6	26	22,8	17,8

The graduated (Table 1) participants were student teachers already had a bachelor degree in a subject but were on a short-term teacher education course called "Formation".

2.2. Data collection instrument

The Approaches and Study Skills Inventory for Students (ASSIST) was used to collect the data. The ASSIST was developed by Tait, Entwistle, and McCune (1998) and translated into Turkish by Senemoglu (2011). In contains 52 statements divided by subscales; deep, strategic and surface approaches. For the translated version of the ASSIST a confirmatory factor analysis was performed and the model produced fit indices to fit the original model (CFI= 97, NNFI=97, RMSEA=0.03) with a Cronbach's Alpha value of 0.81 (Senemoglu, 2011).

2.3. Analysis

The data was analysed by using SPSS 25 program through looking at a one-way between groups multivariate analysis of variance (MANOVA) results for the participants' gender, subject and study years.

3. RESULTS and DISCUSSION

3.1. Science student teachers' approaches to studying based on their gender

A one-way between groups multivariate analysis of variance (MANOVA) shows (Table 2) that there was a statistically significant difference in the three approaches to studying based on science student teachers' gender, F (3, 377) = 3.07, p<.05; Wilk's Λ = 0.976, partial η2 = .024.

Table 2. MANOVA results for science student teachers' approaches to studying based on their gender

Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**
Gender	Wilks' Lambda	,976	3,072	3,000	377,000	,028	,024

Table 3 reveals that while gender has a statistically significant effect on both Strategic approach (F (1, 379) = 4,57; $p < .05$; partial $\eta^2 = .012$) and Surface approach (F (2, 379) = 4,97; $p < .05$; partial $\eta^2 = .013$), it does not have any statistically significant effect on Deep approach to studying (F (1, 379) = 1,29; $p > .05$; partial $\eta^2 = .003$).

Table 3. Tests of between-subjects effects for science student teachers' approaches to studying based on their gender

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Gender	Deep approach	,342	1	,342	1,293	,256	,003
	Strategic approach	1,441	1	1,441	4,569	,033	,012
	Surface approach	1,430	1	1,430	4,971	,026	,013

The mean scores reveal (Table 4) that female science student teachers had higher scores in all three approaches to studying but the differences were statistically significant ($p<.05$) only in strategic and surface approaches to studying (Table 3).

Table 4. The descriptive statistics for science student teachers' approaches to studying based on their gender

	Gender	N	M	SD
Deep approach	Male	113	3,79	,52
	Female	268	3,85	,51
	Total	381	3,83	,52
Strategic approach	Male	113	3,75	,57
	Female	268	3,88	,56
	Total	381	3,84	,56
Surface approach	Male	113	3,43	,54
	Female	268	3,56	,54
	Total	381	3,52	,54

The results of the present study are supportive of the study by Senemoglu (2011) that found out female university students had higher mean scores for both strategic and surface approaches to studying where differences were statistically significant. But the study by Olpak and Korucu (2014) did not find any statistically significant difference between the two genders when surface approach to studying was considered. But in their study, male students had higher mean scores than female students. Only focusing on deep and surface approaches to studying, Olpak and Korucu (2014) also did not find any statistically significant differences in students' approaches to studying when gender was considered. Similarly, Chan (2003) did not reveal any statistically significant differences between the male and female teacher education students in terms of their approaches to studying. Likewise, Ozan and Ciftci (2013) did not found and statistically significant difference between the genders when their approaches to studying was considered. The results of the present study suggest that female student teachers are better in organizing their study, managing time, being alert to the assessment needs, achieving and monitoring effectiveness in comparison to the participant male student teachers. Similarly, male student teachers are less likely to have fear for failure, to be syllabus bounded, to resort to unrelated memorisation and to study with a lack of purpose.

3.2. Science student teachers approaches to studying based on their subjects

A one-way between groups multivariate analysis of variance (MANOVA) shows (Table 5) that there was a statistically significant difference in the three approaches to studying based on science student teachers' subject, $F (9, 912) = 3.02$, $p<.05$; Wilk's $\Lambda = 0.931$, partial $\eta 2 = .024$.

Table 5. MANOVA results for science student teachers' approaches to studying based on their subjects

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Subject	Wilks' Lambda	0,931	3,023	9,000	912,000	,001	,024

Table 6 reveals that while subject has a statistically significant effect on both Strategic approach (F (3, 377) = 3,72; $p < .05$; partial $\eta^2 = .029$) and Deep approach (F (3, 377) = 3,93; $p < .05$; partial $\eta^2 = .03$), it does not have any statistically significant effect on Surface approach to studying (F (3,377) = ,806; $p > .05$; partial $\eta^2 = .006$).

Table 6. Tests of between-subjects effects for science student teachers' approaches to studying based on their subjects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Subject	Deep approach	3,052	3	1,017	3,933	,009	,030
	Strategic approach	3,480	3	1,160	3,722	,012	,029
	Surface approach	,704	3	,235	,806	,491	,006

The post hoc analysis (Table 7) shows that mean scores for deep approach were statistically different between biology and physics student teachers, physics and chemistry student teachers, and physics and primary science student teachers ($p < .05$), but the mean scores for the same variable were not statistically significant between biology and chemistry student teachers, biology and primary science student teachers ($p>.05$). In the same vain the mean difference between chemistry and primary science student teachers were not statistically significant ($p>.05$) with regard to deep approach. The statistically significant differences in terms of strategic approach in student teachers' mean scores were observed between chemistry and physics and chemistry and primary science student teachers ($p < .05$).

Table 7. Post- hoc analysis of the science student teachers' approaches to studying based on their subjects

Dependent Variable	(I) Subject	(J) Subject	Mean Difference (I-J)	Std. Error	Sig.
Deep approach	Biology	Physics	-,2378*	,10169	,020
		Chemistry	,0515	,08045	,523
		Primary Science	,0749	,06748	,268
	Physics	Biology	,2378*	,10169	,020
		Chemistry	,2893*	,10248	,005
		Primary Science	,3127*	,09265	,001
	Chemistry	Biology	-,0515	,08045	,523
		Physics	-,2893*	,10248	,005
		Primary Science	,0234	,06867	,733
	Primary Science	Biology	-,0749	,06748	,268
		Physics	-,3127*	,09265	,001
		Chemistry	-,0234	,06867	,733
Strategic approach	Biology	Physics	-,2161	,11162	,054
		Chemistry	,1425	,08830	,107
		Primary Science	-,0364	,07406	,623
	Physics	Biology	,2161	,11162	,054
		Chemistry	,3586*	,11248	,002
		Primary Science	,1796	,10169	,078
	Chemistry	Biology	-,1425	,08830	,107
		Physics	-,3586*	,11248	,002
		Primary Science	-,1789*	,07537	,018
	Primary Science	Biology	,0364	,07406	,623
		Physics	-,1796	,10169	,078
		Chemistry	,1789*	,07537	,018

The differences revealed by the table above can be easily visualised by the plots showing the estimated marginal means of strategic and deep approaches (Diagram 1 and Diagram 2).

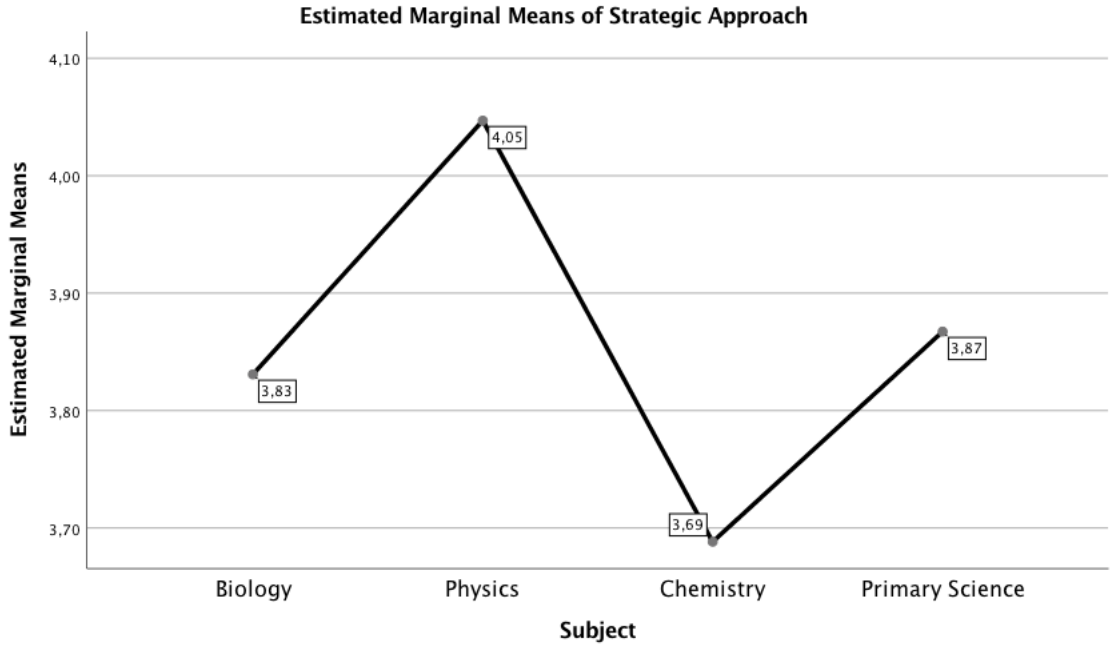

Diagram 1. The estimated marginal means of strategic approach

The Diagram 1 shows that in terms of strategic approach, physics student teachers had the highest mean score of 4.05 followed by primary science student teacher with the mean score of 3.87, biology student teachers with the mean score of 3.83 and chemistry student teachers with the lowest mean score of 3.69.

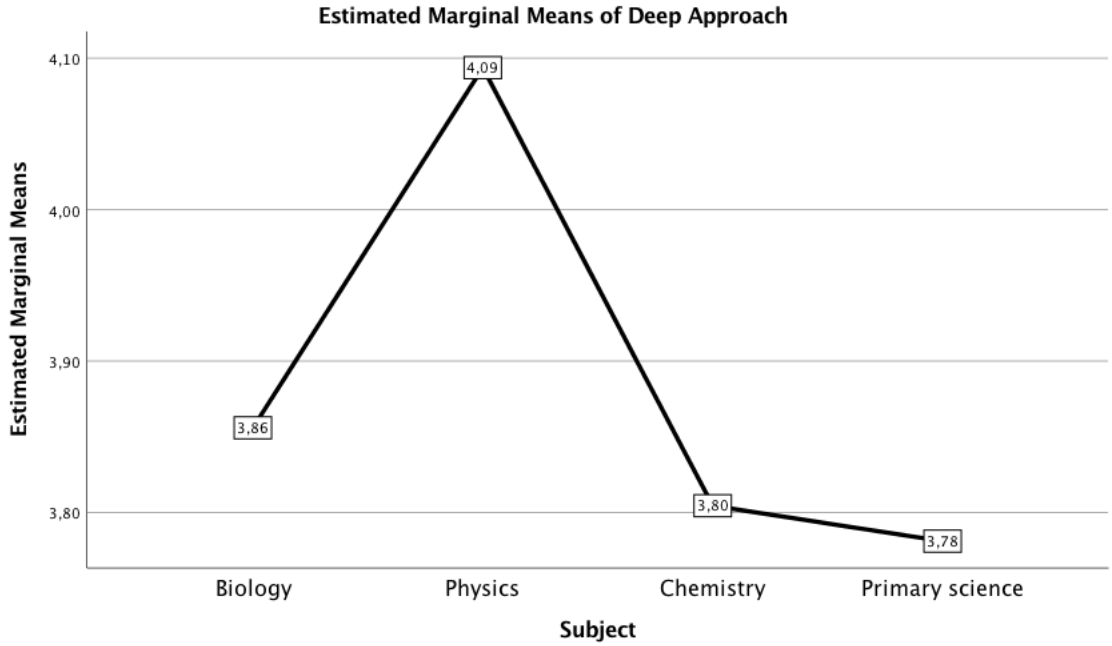

Diagram 2. The estimated marginal means of deep approach

The Diagram 2 exhibits that physics student teachers were the most likely of the participants in terms of taking a deep approach to studying with a mean score of 4.09 followed by biology student teachers with a mean score of 3.86 and chemistry student teachers with a mean score of 3.80, while the primary science student teachers were the least likely to follow a deep approach to studying among the participant student teachers with a mean score of 3.78.

The previous studies in the field report different results in student approaches to studying when the subjects are considered. Senemoglu (2011), for example, found statistically significant difference only in deep approach to studying. And humanities students had higher mean scores in comparison to preschool and math-science students. In the same vain, Olpak and Korucu (2014) did not find any statistically significant difference in student approaches to studying when students' majors were considered. Similarly, Ozan and Ciftci (2013) did not report any statistically significant difference in student teachers approaches to studying when their subject was considered. But Smith and Miller (2005) found the subject students studying was a major factor for the approach students prefer for studying. The present study revealed that while students' major was important factor for deep and strategic approaches, it was not a distinguishing factor for surface approach to learning.

3.3. Science student teachers approaches to studying based on their year of study

A one-way between groups multivariate analysis of variance (MANOVA) shows (Table 8) that there was a statistically significant difference in the three approaches to studying based on science student teachers' year of study on the teacher education course, F (3, 377) = 3.189, p<.05; Wilk's Λ = 0.904, partial η2 = .033.

Table 8. MANOVA results for science student teachers' approaches to studying based on their year of study

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Year of study	Wilks' Lambda	,904	3,189	12,000	990,000	,000	,033

Table 9 reveals that while year of study has a statistically significant effect on both Strategic approach (F (4, 377) = 3,141; $p < .05$; partial $\eta^2 = .032$) and Deep approach (F (4, 377) = 2,858; $p < .05$; partial $\eta^2 = .03$). But the results do not yield any statistically significant effect of study year on Surface approach to studying (F (3,377) = 1,423; $p > .05$; partial $\eta^2 = .015$).

Table 9. Tests of between-subjects effects for science student teachers' approaches to studying based on their year of study

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Study year	Deep approach	2,968	4	,742	2,858	,023	,030
	Strategic approach	3,912	4	,978	3,141	,015	,032
	Surface approach	1,646	4	,412	1,423	,226	,015

The post hoc analysis (Table 10) shows that mean scores for deep approach were statistically significant between graduated and 1st, 2nd and 4th year student teachers ($p < .05$). But the mean scores for the same variable were not statistically significant between the graduated and 3rd year student teachers ($p>.05$). The results also show that the statistically significant differences in the strategic approach to studying in terms of study year were largely due to the differences between the 4th year student teachers and 1st and 2nd year student teacher and between the graduated and the 1st year student teachers ($p < .05$).

Table 10. Post- hoc analysis of the science student teachers' approaches to studying based on their year of study

Dependent Variable	(I) Year of Study	(J) Year of Study	Mean Difference (I-J)	Std. Error	Sig.
Deep approach	Graduated	Year 1	,2062*	,08532	,016
		Year 2	,2963*	,09386	,002
		Year 3	,1295	,08025	,107
		Year 4	,1752*	,08247	,034

Strategic approach	Year 4	Year 1	,2919*	,08792	,001
		Year 2	,2085*	,09781	,034
		Year 3	,1444	,08200	,079
		Graduated	,0816	,09032	,367
	Graduated	Year 1	,2103*	,09343	,025
		Year 2	,1269	,10279	,218
		Year 3	,0628	,08788	,475
		Year 4	-,0816	,09032	,367

The differences revealed by the table above can also be easily visualised by the plots showing the estimated marginal means of deep, strategic and also surface approaches to studying (Diagram 3, 4 and 5).

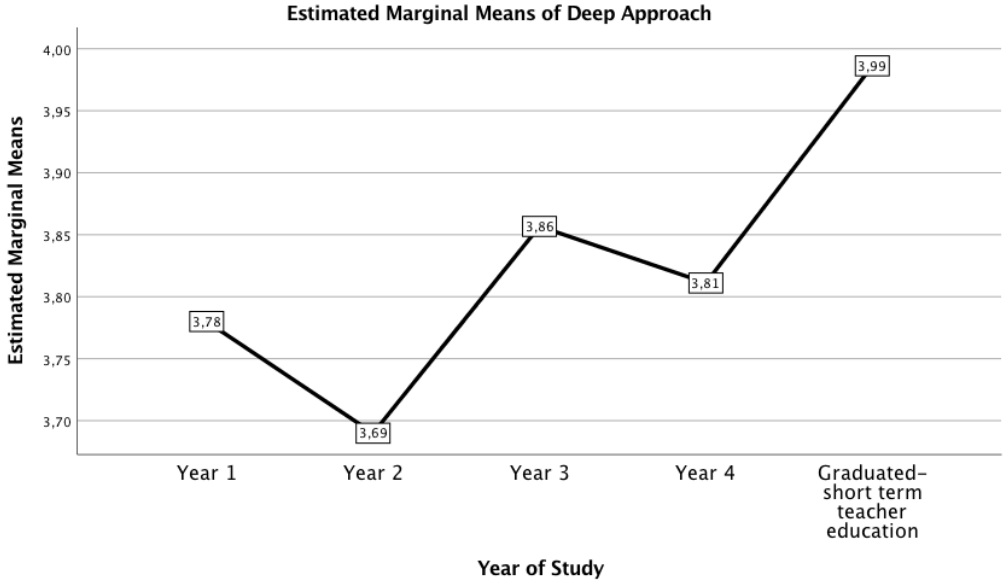

Diagram 3. The estimated marginal means of deep approach based on the study year

The Diagram 3 shows that 4th year student teachers were most likely to resort to the deep approach to studying with a mean score of 3.99 followed by 3rd year students with a mean score of 3.86 and 4th year student teachers with a mean score of 3.81. When all participants were considered based on their study year, 1st year and second year students were least likely to follow a deep approach to studying with mean scores of 3.78 and 3.69.

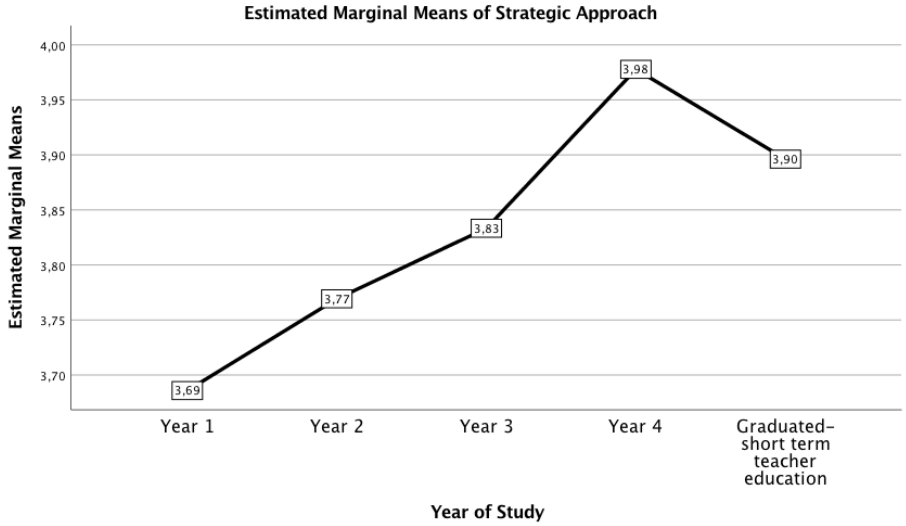

Diagram 4. The estimated marginal means of strategic approach based on the study year

The Diagram 4 displays that the 4th year student teachers had the highest mean scores (3.98) for the strategic approach to studying followed by graduated student teachers with a mean score of 3.90, 3rd year student teachers with a mean score of 3.83 and 2nd year student teachers with a mean score of 3.77. The diagram also shows that the 1st year student teachers were least likely to follow a strategic approach to studying among the participant student teachers with a mean score of 3.69. It is interesting to observe from the Diagram 4 that as student teachers went further into the teacher education courses they were more likely to follow a strategic approach to studying.

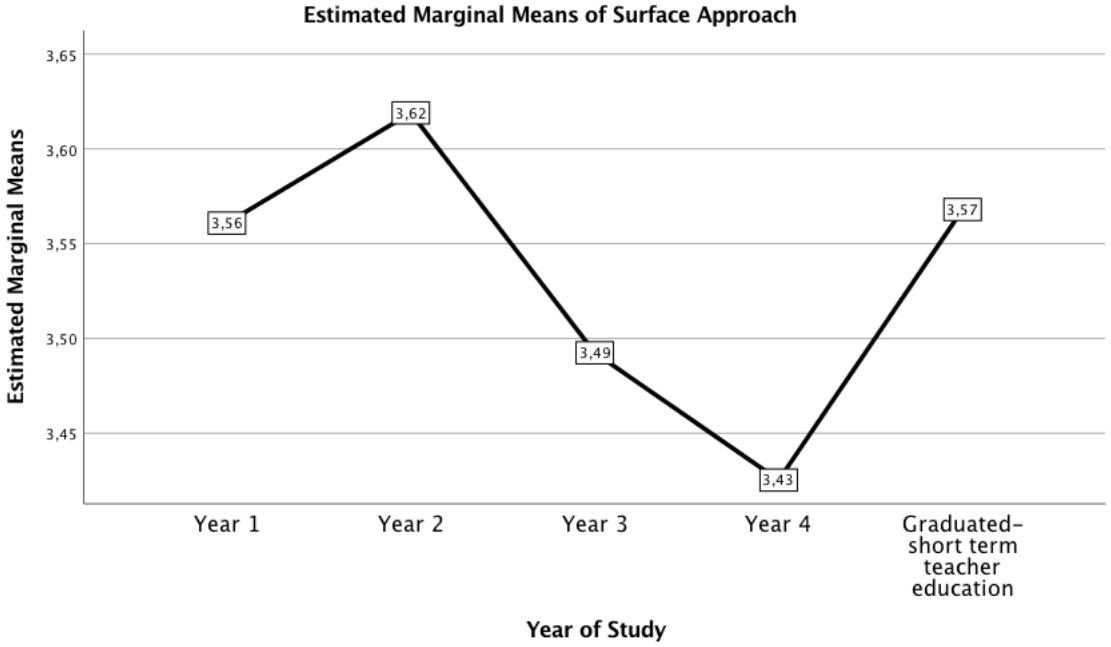

Diagram 5. The estimated marginal means of surface approach based on the study year

The Diagram 5 shows that the second, graduated and first year student teachers were more likely to take a surface approach in their preferences for studying with mean scores of 3.62, 3.57 and 3.56, while the 4th and 3rd year student teachers were the least likely among the participants to resort to the surface approach to studying with mean scores of 3.43 and 3.49. The study carried out by Ozan and Ciftci (2013) and Olpak and Korucu (2014) did not find any statistically significant differences in student teacher approaches to studying in terms of their study years. The study by Senemoglu (2011) reports a significant difference only in surface approach to studying. The present study found statistically significant differences in science student teachers approaches to learning both in deep and strategic approaches when study years was considered. The results show as students become matured they look for meaning, evidence, relate ideas, grow interest in ideas as well as becoming better in organizing studying, time management, being alert to the assessment demand, achieving and monitoring effectiveness. the study did not find any statistically significant difference in surface approach when the study years was considered. But the mean scores clearly show as 1st and 2nd year students are more inclined toward surface approach to studying than the 3rd and 4th year science student teachers.

4. CONCLUSION

This study investigated science student teachers' preferences for studying based on their gender, subject and study years. The study found statistically significant differences in student teachers approaches to studying in the all three variables. Knowing student teachers' preferences for studying is important as it provides the educators to present opportunities for students to enhance their learning in best possible way. It is important for teacher educators to encourage students for deep approach to

studying as prospective teachers they will be more likely to help their students to employ deep approach to studying in the future. This can also be used as a mean to develop process skills such as critical thinking, reflective thinking and meaningful learning. Therefore, it is important for teacher education courses to incorporate subjects that help student teachers to develop skills for deep approach to studying.

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