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Laboratory Self-Efficacy Levels of 1st and 4th Grade Level of Engineering Students

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Abstract

There is limited number of studies done on students' laboratory self-efficacy values, especially on engineering students. For that reason, aim of this study was to investigate the laboratory self-efficacy values of engineering students. Research hypothesis was laboratory self-efficacy values increase with grade level. For that reason, a laboratory self-efficacy scale was applied to volunteered 35 students studying at 1st grade level and 30 students studying at 4th grade level. Thus, study group consisted of 65 students studying at engineering faculty. For the purpose of the study purposive/convenience sampling method was chosen. Laboratory self-efficacy scale had .786 Cronbach's alpha internal consistency value. Students' responses to each item in the scale were shown in the table. Also total scores were calculated with respect to non-refined method. Total scores for the grade levels were compared with independent samples t test. Test results revealed that there was no significant difference between the grade levels in terms of laboratory self-efficacy values. It was also observed that 4th grade level students obtained higher scores only on two items than 1st year students. It is believed that limited conclusion obtained from this research would provide valuable milestones for the researchers who want to investigate laboratory self-efficacy values of engineering students or any other departments which has laboratory courses in their curriculum.

Keywords: Engineering students, Laboratory, Laboratory self-efficacy, Self-efficacy

INTRODUCTION

Students' attitudes towards science is an increasing concern in research trends since popularity of choosing a science related professions seem to decrease. Additionally, choosing a profession is also related with attitudes. Thus, knowing students attitudes' is important since it affects the behavior. Knowledge is ephemeral while on the other hand attitudes are enduring and effective on acts. For that reason, it is important for teachers to know the attitudes of students. Yet, studies are mostly focused on the effect of methods on academic achievement but few studies done on the effect of attitudes (Erdogan, 2017; Osborne, 2003; Price & Lee, 2013).

Attitudes are effective on behaviors and are affected by different factors. Studies indicate that there are several factors affecting the attitudes. For example, location of the house (city center, urban, rural etc.) has significant effect both on attitudes toward science and nature of science in favor of centered location of housing. Such studies indicated that socioeconomic status of students is also important (Yenice & Saydam, 2010). Another factor might be listed

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as educational settings. For example, Germann (1988) studied school assessment relationship with students' attitudes towards science in school achievement context. Student, teacher and learning environment are also effective on students' scientific attitude. Social and psychological factors such as enjoyment of classmates, school and class environment might be listed as other factors which are effective on attitudes. Even classroom organization is effective on scientific attitudes. (Olasehinde & Olatoye, 2014). Effectiveness of science teacher and learning environment also affect the attitude. Motivation shapes or creates actions through beliefs, and attitudes. Even the characteristics or habit of thinking of an individual might affect the attitude (Mukhopadhyay, 2004).

Laboratory courses are helpful in constructing meaningful learning. Thus, a good laboratory course might be also called a place where the construction of science and scientific knowledge made (Bretz, 2019). For that reason, researches related to laboratory courses are important since they provide valuable information for the teachers. Teachers who are aware of the laboratory courses could provide more benefits to his/her students (Boud, Dunn, Kennedy & Thorley, 1980). For example, Alghamdi (2017) indicated that traditional approach in laboratory courses provides higher positive attitudes towards science when compared to Jigsaw method.

Self-efficacy is defined as someone's belief in his/her capacity. Consequently, it has effects on attitudes. Extensive research done on self-efficacy is also indication of its importance (Hyde et al., 2008; Usher & Pajares, 2008). However, self-efficacy has dimensions and a person with low self-efficacy belief in one dimension doesn't mean that s/he will have low self-efficacy on other dimensions too. Thus, in order to have an idea about someone's self-efficacy level, proper assessment measures must be used (Bandura, 1997). For that fact, assessing students' science self-efficacy doesn't mean that the results will reveal the laboratory self-efficacy values. As a consequence, using proper measures is important and having idea upon students' laboratory self-efficacy beliefs would benefit teachers (Gezer, 2015; Kurbanoglu & Akim, 2010). In that sense, purpose of this study was to determine the laboratory self-efficacy levels of engineering faculty students.

Research statement of this study were

1. What is the level of self-efficacy values of 1^{st} and 4^{th} grade level engineering faculty students?
2. Do laboratory self-efficacy beliefs of engineering students change with respect to grade levels?

METHOD

Research design

Survey research design was used for the study since it would ease collecting and analyzing the data. Data collection method was questionnaire. The reason for choosing questionnaire was collecting data from the respondents would be easy. Questionnaires are useful to gather information in a short period of time (Karasar, 2009; Ponto, 2015).

Data collection tool

Data collection tool was laboratory self-efficacy scale (LSES) which was developed by Akkus (2020). LSES consists of 10 likert type items and has two factor structures which are laboratory positive skills perception and laboratory negative skills perception. The developed LSES' overall Cronbach's alpha value was .898. LSES was distributed to respondents via Google forms. LSES' Cronbach's alpha value for this study was .786 which was reliable (Kalaycı, 2010).

Study group and sampling method

Since the study aimed to analyze between freshman and senior students' attitudes, researcher asked one of the faculty members to share the link of LSES with his/her students who were taking courses from the faculty member. Participation in the study was on volunteer basis. Thus, sampling method of the study was purposive/convenience sampling method. This sampling method is used for the convenience of the research or researcher (Büyüköztürk et al., 2016). 35 students studying at 1st and 30 students studying at 4th grade level students participated in the study. Study group consisted of 65 engineering faculty students in total.

Data analysis

Data findings through the scale items and its distribution with respect to grade levels were shown with respect to each item in LSES. Scale item responses were graded from 1 to 5. For that reason a person may have lowest score 1 and highest score 5 in one item response. Scale has 10 items so, lowest score might be get from the scale was 10 and highest score might be get from the scale was 50. Total scores were calculated by adding the scales response sums for non-refined methods (DiStefano, Zhu & Mindrila, 2009).

Normality analysis

In order to determine which tests to apply, a normality analysis was checked. It was found that data was normally distributed with a skewness of -,358 (SE= ,297) and a kurtosis of 1,255 (SE= ,586) within the %1 significance level (Kalaycı, 2010; Rose, Spinks & Canhoto, 2014).

Findings

Item response results

Table 1. *Students' responses to items*

Statement	Grade	N	M	SD
1. I believe that I will get high scores from laboratory courses	1st	35	3,89	,796
	4th	30	3,77	1,040
	Total	65	3,83	,911
2. I can easily learn what is asked from me to learn in laboratory courses	1st	35	4,03	,747
	4th	30	4,00	,947
	Total	65	4,02	,838

3. I believe I can do experiments better than other students	1st	35	3,74	,980
	4th	30	3,63	1,066
	Total	65	3,69	1,014
4. If I work harder I will become successful on conducting experiments	1st	35	4,23	1,003
	4th	30	4,27	,944
	Total	65	4,25	,969
5. I don't think my laboratory course grade will be high	1st	35	3,20	1,079
	4th	30	3,10	1,296
	Total	65	3,15	1,176
6. I am confident that I will get high scores on laboratory exams	1st	35	3,71	,789
	4th	30	3,83	,913
	Total	65	3,77	,844
7. I think I can do experiments successfully	1st	35	4,11	,530
	4th	30	3,87	,937
	Total	65	4,00	,750
8. I don't count as better student when compared with my classmates	1st	35	3,60	,914
	4th	30	3,13	1,196
	Total	65	3,38	1,071
9. I believe I will fail at experiments	1st	35	4,09	,981
	4th	30	3,47	1,306
	Total	65	3,80	1,175
10. I think I can easily teach my friends what I learned from laboratory courses	1st	35	4,09	,781
	4th	30	4,00	,871
	Total	65	4,05	,818

Items and students' responses with respect to grade levels were shown in Table 1. Students had positive laboratory self-efficacy values since item response scores were above 3.0. On the other hand, 4th grade level students had higher scores than 1st grade level students only on two items. Those items were item 4 and item 6.

Independent samples t test result

In order to determine whether there was significant difference between the grade levels in terms of total scores, an independent samples t test was run and its result was shown in Table 2.

Table 2. *Independent samples t test results*

	N	**M**	**SD**	**t**	**p**
1st Grade	35	38,69	5,161	1,155	,253
4th Grade	30	37,07	6,147		

Independent samples t test result indicated that there was no significant difference between the grade levels in terms of laboratory self-efficacy beliefs.

DISCUSSION

Taking glance upon the scale item values it is possible to say that engineering faculty students had positive laboratory self-efficacy values since item response scores were above 3.0. On the other hand, it was expected that since 4th grade students were seniors and had

familiarity with laboratory courses they would put forward significant differences on the items and on total scores. Yet, it is noteworthy that 4th grade level students had higher scores only on two items which were item 4 and item 6 (Table 1). On the other hand, independent samples t test result (Table 2) revealed that there wasn't significant difference between the grades in terms of laboratory self-efficacy scores.

Aka (2016) reached similar findings that self-efficacy values of the students didn't produce any significant statistical values between the grade levels. Gurvitch & Metzler (2009) indicated that as the encountered real life experiences increased by the students then, there might be decrease in self-efficacy values. In that case it might be assumed that 4th grade students are about to be an engineer and encountered more obstacles than 1st year students. For that reason, high scores presented by 1st year students might sense. This idea might be also supported by Şen & Sezen Vekli (2016)'s study since they studied with 2nd year students and indicated that inquiry based instruction applied in laboratory might have positive effect on the students' laboratory self-efficacy scores. However, Shea & Howell (1999) studied with faculty graduates and claimed leadership presented in the laboratory might have positive effect on students' task quality and increase their self-efficacy values. As a further note, it should be mentioned that only Şen & Sezen Vekli (2016) used a laboratory self-efficacy scale for the laboratory courses.

Although literature indicates many researchers done both on self-efficacy and laboratory, and their relationships with each other, within our knowledge, there are limited studies done on the laboratory self-efficacy. In addition, published studies mostly focused on laboratory self-efficacy values carried out with either teachers or teacher candidates. This study investigated laboratory self-efficacy of engineering students. Thus, it is believed limited findings of this study might provide a valuable milestone.

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