CSSR2019

6th International Conference on Science & Social Research 2019
https://cssr.uitm.edu.my/2019/
Parkroyal Penang Resort, Batu Ferringhi, Pulau Pinang, Malaysia, 04-05 Dec 2019

Student's Learning Style and Achievement after being Taught Contextually

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Abstract
Contextual learning combines examples taken from everyday experience. The purpose of this research is to identify whether learning contextually will improve students' achievement. A quasi-experimental design used. The engineering students were divided into contextual and non-contextual groups. The Neuro-Linguistics Programming (NLP) VAKD Preferred Representational Systems Test shows, majority of both groups use auditory digital learning styles. There is a significant difference at a significance level of .05, in the achievement test where the contextual groups performed better. The majority of the students in both groups are auditory digital learning styles, learning statistics contextually is an effective method for engineering students.

Keywords: NLP VAKD, learning styles, statistics, contextual

1.0 Introduction

Students do not have the same learning styles because they have from different backgrounds. Even though researchers define the terms learning style differently, most of them focus on the preferences when accepting information—learning styles influence a learner's information processing and cognition in terms of attention, perception and thinking and learning behaviour (Shukri et al., 2013).

Research on the preferred learning style of engineering students has been done. The findings are different as there are many different types of learning style questionnaires. According to Driscoll & Garcia (2000), results obtained from the profiles of freshmen and junior-level Chemical Engineering students using VARK indicate that students preferred kinaesthetic (hands-on) mode, either by itself or in combination with other learning styles (multimodal). In the study done by Tulsi, Poonia and Anu (2016), from the sample of 175 students, there exist differences in learning styles of civil, electrical, electronics, communication and mechanical engineering students, and also of the computer science and engineering post-graduate students. The majority of the students of various branches except mechanical engineering prefer active, sensing, visual and sequential learning styles. Sahatcija, Ora, and Ferhataj (2017) used the Gregorc (2017) classification, which consists of four categories: concrete-sequential, concrete random, abstract-sequential, abstract-random, and they found out that most Albanian university students use the first thinking style, namely concrete-sequential thinking style. According to Ictenbas & Eryilmaz (2011), to meet the needs of those students in different ways, instructors must design their courses differently. In their research using the Turkish version of the VARK questionnaire, from 20 engineering students, approximately 25 % of students prefer many learning styles within the classroom. This is followed by the kinaesthetic style, which

requires real-life practice to enhance knowledge of the subject. This study has also shown that engineering students prefer applied instruction to improve their analytical and problem-solving skills.

Gaikwad (2017) said that critical question is ponder upon as the learning style of the students have a big impact on the way they perceive and learn. She said that by the application of different learning styles to teach various courses by educators, the learning could be improved. This is because, from her research using the survey conducted by Felder Solomon learning index, most of the engineering students are active, intuitive, visual and sequential learners, while most of the engineering-pedagogical styles tend to emphasize the opposite methods. In making these students motivated and interested in their studies, she added that faculties should take care to use appropriate strategies in generating employable engineers.

The thinking style that was used in this research is from the Neuro-Linguistics Programming (NLP) Preferred Representational Systems Test. NLP or Neuro-Linguistic Programming by Richard Bandler and John Grindler identify four primary modalities for learning: Auditory, Auditory, Digital, Visual and Kinaesthetic. According to Losier (2009) and Mahoney (2007), Auditory people learn best by listening and often do not take notes; people who are Auditory Digital learn best by working things out in their mind, Visual people learn best by creating visual pictures in their mind and Kinaesthetic people, learn best through doing.

This research focused on students' achievement when they were taught using contextual approaches in learning statistics. It was intended to ascertain how this approach would affect learning transfer between the class lectures to real-life situation problems. In contextual teaching and learning, students discover meaningful relationships between abstract ideas and practical applications in the context of the real world; concepts are internalized through the process of discovering, reinforcing, and relating. They want the answer to the question "Why do I have to learn this?" (CORD, 1999, 2016). The contextual lesson proposed by CORD (1999) is done so that it contains numerous examples that clarify concepts and provide students models for solving applied real-world problems; it provides students with an interesting and relevant way of translating mathematics from an abstract, theoretical approach to concrete. In this research, students learn statistics contextually by giving real-world examples, solving real-world problems, and showing real-world simulation videos on statistics.

2.0 Methodology

This study used a Quasi-experimental design. Two hundred sixty-eight diploma students from six classes which consisted of two classes of civil engineering students, two classes of electrical engineering students and two classes of mechanical engineering students. For this research, these six classes were divided into two main groups: control group or non-contextual group (NCTL) and experiment or contextual group (CTL). Six combinations of these classes were constructed, and a t-test was done to find out whether there was any significant difference in the combination of the classes. There were two classes for civil engineering students. If Class 1 Civil was selected in the non-contextual group, then Class 2 Civil would be in the contextual group. The same thing for Class 3 Electrical with Class 4 Electrical and Class 5 Mechanical with Class 6 Mechanical. From these selections, each group would have all three fields so that the field of studies would be a control variable. The six combinations of classes are shown in Table 1.

Table 1. Summary of the combination of the class

Class Combination	Civil		Electrical		Mechanical	
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Combination 1: CNNCCN	CTL	NCTL	NCTL	CTL	CTL	NCTL
Combination 2: NCCNNC	NCTL	CTL	CTL	NCTL	NCTL	CTL
Combination 3: CNNCNC	CTL	NCTL	NCTL	CTL	NCTL	CTL
Combination 4: NCNCNC	NCTL	CTL	NCTL	CTL	NCTL	CTL
Combination 5: CNCNNC	CTL	NCTL	CTL	NCTL	NCTL	CTL
Combination 6: NCNCCN	NCTL	CTL	NCTL	CTL	CTL	NCTL

(C: contextual, N: non-contextual)

Then t-test was done to find out whether there was any significant difference between the two groups: non-contextual and contextual groups of the combination of the classes. There was significant difference between the two groups for combination 1 (P = .00), combination 2 (P = .00), combination 3 (P = .02) and combination 4 (P = .01) at a significance level of .05 as shown in Table 3.8. However, there was no significant difference between the two groups for combination 5 (P = .22) and combination 6 (P = .22) at a significance level of .05 as shown in Table 3.9. Since there is a significant difference between Class 1 with a mean of 15.80 and Class 2 with a mean of 12.29, Class 2 was chosen to be in the Contextual (CTL) group. This was to study whether a contextual approach can improve students' understanding of statistics. Thus, the combination that was chosen is Combination 6.

Table 2. Significant Difference between the Non-contextual and Contextual

Combination	Combination 1: CNNCCN	Combination 2: NCCNNC	Combination 3: CNNCNC	Combination 4: NCNCNC	Combination 5: CNCNNC	Combination 6: NCNCCN
p	0.000	0.000	0.018	0.008	0.224	0.224

Significant	Yes	Yes	Yes	Yes	No	No

(C: contextual, N: non-contextual)

All students answered the NLP Preferred Representational Systems Test to determine their learning style. Then the contextual group was taught statistics contextually using Contextual Statistics Modules, while the non-contextual group was taught statistics non-contextually using non-contextual Statistics Modules. After the researcher finished teaching, the contextual video or non-contextual video, based on their groups, were shown to them. The video is in English; however, during the video presentation, the researcher explains both in English and Malay. While showing the video to the students, the researcher explained or repeated the main points of the videos to the students. Then the students were given an achievement test. There were six questions in the test. The first two questions were problem-solving non-contextual questions; the next two questions were problem-solving contextual questions. As for the last two questions, both tests ask about the application of real-life events, which were normal or non-normal distribution.

3.0 Findings and Discussion

From the Neuro-Linguistics Programming (NLP) Preferred Representational Systems Test, Table 3 shows the distribution learning styles of the students in the Non-contextual group and the Contextual group. Thus, from these tables, the majority of the students for both groups had auditory digital learning styles, with 57 students in the non-contextual group and 59 students in the non-contextual group.

Table 3 The Distribution of the Learning styles for the Non-contextual Group

Learning Style	Visual	Auditory	Kinaesthetic	Auditory Digital	Unknown	Total
Non-contextual	18	18	41	57	2	141
Contextual	20	18	28	59	7	127
Total	38	36	69	116	9	168

Two-way ANOVA has been analyzed to investigate whether there is any significant difference in the non-contextual questions in the test between the two groups. Table 4 represent the variables in this test.

Table 4 two-way ANOVA analyses for Problem Solving Non-contextual Questions

Source	Type II Sum of Squares	df	Mean Square	F	p-value
Corrected Model	140.615*	2	70.308	1.952	0.144
Intercept	50569.141	1	50569.141	1403.90	0.000
non-contextual_contextual	120.731	1	120.731	4	0.068
Error	9545.396	265	36.020	3.352	
Total	60135.000	268			
Corrected Total	9689.011	267			
a. R squared = .015 (Adjusted R Squared = 0.007)Total					

From Table 4, there is no significant difference in the problem solving non-contextual questions from the Post Test at a significance level of .05 ($P = 0.07$).

Two-way ANOVA has been analyzed to investigate whether there is any significant difference in the problem solving contextual questions in the test between the two groups. Table 5 represent the variables in this test.

Table 5 two-way ANOVA analyses for Problem Solving Contextual Questions

Source	Type II Sum of Squares	df	Mean Square	F	p-value
Corrected Model	241.867a	2	120.933	3.252	0.040
Intercept	38226.668	1	38226.668	1028.01	0.000
non-contextual_contextual	234.643	1	234.643	7	0.013
Error	9853.984	265	37.185	6.310	
Total	48114.000	268			
Corrected Total	10095.851	267			
a. R squared = .015 (Adjusted R Squared = 0.007)Total					

There is a significant difference in the problem solving contextual question from the Post Test at a significance level of .05 ($P = 0.013$). The contextual group perform better, as shown in Table 6 with a mean of 12.90 and a standard deviation of 5.91, compared to the Non-contextual group, with a mean of 11.02 and a standard deviation of 6.24.

Table 6 The Mean and Standard Deviation for Problem Solving Contextual Questions

Test	Mean	Std Deviation	N
Non-contextual	11.02	6.24	141
Contextual	12.90	5.91	127
Total	11.91	6.15	268

Two-way ANOVA has been analyzed to investigate whether there is any significant difference in the application of statistics questions in the test between the two groups. Table 7 represent the variables in this test.

Table 7 two-way ANOVA analyses for application of statistics questions

Source	Type II Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1446.337*	2	723.169	179.141	0.040
Intercept	4169.705	1	4169.705	1032.90	0.000
non-contextual_contextual	1445.128	1	1445.128	8	0.000
Error	1069.767	265	4.037	357.983	
Total	6444.000	268			
Corrected Total	2516.104	267			
a. R squared = .015 (Adjusted R Squared = 0.007)Total					

There is a significant difference in the contextual question from the Post Test at a significance level of .05 (P = 0.000). The contextual group perform better, as shown in Table 8, with a mean of 6.28 and a standard deviation of 2.21, compared to the Non-contextual group, with a mean of 1.62 and a standard deviation of 1.80.

Table 8 The Mean and Standard Deviation for Questions on Application of statistics

Test	Mean	Std Deviation	N
Non-contextual	1.62	1.80	141
Contextual	6.28	2.21	127
Total	3.83	3.07	268

For both groups, there is no significant correlation between the learning styles (VAKD) and the achievement scores, as shown in Table 8 for the Contextual Group and in Table 9 for the Non-contextual Group.

Table 9 Correlation Between The Learning Styles And Achievement Scores for The Non-Contextual Group

Learning Style		total score
NLP_V	Pearson Correlation	-0.104
	p-value	0.218
	N	141
NLP_A	Pearson Correlation	-0.028
	p-value	0.744
	N	141
NLP_K	Pearson Correlation	-0.067
	p-value	0.427
	N	141
NLP_D	Pearson Correlation	0.076
	p-value	0.372
	N	141

From Pearson correlation, all the learning styles do not show any significant correlation with the achievement score for the non-contextual group, as shown in Table 10.

Table 10 Correlation Between The Learning Styles And Achievement Scores for The Contextual Group

Learning Style		total score
NLP_V	Pearson Correlation	0.072
	p-value	0.423
	N	127
NLP_A	Pearson Correlation	0.035
	p-value	0.699
	N	127
NLP_K	Pearson Correlation	0.023
	p-value	0.800
	N	127
NLP_D	Pearson Correlation	0.04
	p-value	0.964
	N	127

From Pearson correlation, all the learning styles do not show any significant correlation with the achievement score for the contextual group.

4.0 Conclusion

The educators must know the learning style of their students. According to Richard M. Felder and Linda Silverman, it was found out that the mismatches between the methods of teaching and the student learning styles lead to poor student performance, professorial frustration, and a loss to society of many potentially excellent engineers (Felder, 2002). Even though researchers define the terms

learning style differently, most of them focus on the preferences when accepting information. For example, Gokalp (2013) said that learning styles are not concerned with "what" learners learn, but rather "how" they prefer to learn, which is an important factor for students' academic achievement and attitudes.

Students taking engineering courses must be good at logical and critical thinking. It is important, as they have to make clear and rational decisions. These decisions need a process thought that is not only structured but also very important a logical. From this research, as the predicted majority of the students are auditory digital. These students memorize by steps and sequences process information rationally and logically (Losier, 2009). Therefore in this research, as expected, the majority of the students use Auditory Digital learning style instead of saying something "looks good", "sounds right", "feels nice", "tastes good", or "has the smell of success", a person with a preference for auditory digital may say, "this makes sense", "is logical" or "the specifications are correct" (Ellerton, 2013). This finding is similar to the research done by Tulsi et al. (2016), where engineering students prefer active and sequential learning styles. Sequential learning style must follow a logical style. For example, electrical engineering students must design basic components for sequential logic circuits. This finding is also similar to the research by Gaikwad (2017), where most of the engineering students are active, intuitive, visual and sequential learners. In addition, research by Ictenbas and Eryilmaz (2011), using the Turkish version of the VARK questionnaire, shown that engineering students prefer applied instruction to improve their analytical and problem-solving skills. However, results obtained from the research done by Driscoll et al., (2000) for a class of freshmen and junior-level Chemical Engineering students, using VARK, indicate that students preferred kinaesthetic (hands-on) mode, either by itself or in combination with other learning styles (multimodal).

In learning contextually, students learn how to relate what they learn in class to the real world. Students discover meaningful relationships between abstract ideas and practical applications in the context of the real world. From the contextual learning method, concepts are internalized through the process of discovering, reinforcing, and relating. This study shows that majority of the students learning style is auditory Digital, where these students learn by working things out in their mind and memorizing by steps and sequences process information rationally and logically. However, students usually were taught mechanistically where they use the formula without understanding the logic behind it. They just repeat what was learn and do not understand the concept of the topics. They have difficulty in relating what they learn in class to real-life questions, as they were not able to apply the concept of Normal Distribution in the real world. In addition, they were not taught to solve real-life questions, as they were unable to answer the questions. Based on the literature review, students try to find meaning in what they learn so that they can relate between abstract ideas and practical applications. From this study, students taught in the contextual method performed better than the non-contextual group. Thus, this method of teaching is suitable for students who have auditory digital learning styles.

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