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The impact of technology, learning style, instructional approach, and attitude on learning outcomes

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ABSTRACT

The study aims to investigate the relationship between the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude toward learning outcomes. Quantitative correlation model, a semi-structured instrument, and a cluster random sample of subjects (N=319) were decided to be employed in the research-study. The study reported a relatively low positive relation between learners' technology experiences and learning outcomes variables (r=.328), an intermediate positive connection between cooperative learning style and learning outcomes constructs (r=.485), a relatively low positive association in the middle of student-centered instructional approach and learning outcomes (r=.394), as well as between positive student attitude and learning outcomes (r=.329). The whole variance of learning outcome levels described by cooperative learning style is 34.7%, by student-centered instructional approach is 23.9%, by positive student attitude is 10.8%, and by learners' technology experiences is 5.6%. The results of the study are important for departments as well as for lecturers and students.

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1. INTRODUCTION

The learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude are supposed to be the significant constructs that affect the learning outcomes of students at the university. The study aimed to investigate the relations connecting learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude toward learning outcomes. The main research question is as: Is there a positive linear correlation between learners' technology experiences, cooperative learning style, student-centered instructional approach, student attitude, and learning outcomes? Do learning outcomes increase with learners' technology experiences, cooperative learning style, student-centered instructional approach, and student attitude? How much change in learning outcomes scores can be explicated by the learners' technology experiences, cooperative learning style, student-centered instructional approach, and student attitude?

The conceptual compound of the main constructs selected to be used in the study are presented. Learners' technology experiences mean students' skills in using different forms of technological tools, including e-learning to enhance their learning and academic progress and master new language skills through exposure to a variety of new technologies referring to MacLean and Elwood [1]. A cooperative learning style indicates students' learning is supported by each-other interactions [2], as well as by interaction between themselves and lectures, including problem-based learning [3]. The student-centered instructional approach

stands for teaching where the students are in the center, and where the lectures serve as the facilitator of the knowledge building using different active and inclusive teaching techniques [4]–[6]. "The positive approaches support a better understanding of the nature of learning for the students, it also makes them more open to academic progress, increases their objectives from the teaching activity, and reduces the anxiety scales" [7], [8]. A positive student attitude means being willing to attend and participate in discussions as well as in other teaching activities which makes the students more open to learning, increases their expectations from the learning process, and reduces their anxiety levels [7]. So, finally, learning outcomes signify the outputs of the teaching and learning process [4], including the academic success of students, as well as academic performance [9].

The theoretical framework for the study was based on constructivist theory [10]–[12]. The research work about child's development and education led to the consolidation of constructivism. Research by Howe and Berv [13] indicated that "the constructivist model asks active participation in the teaching process, where students take part in building understanding." Theoretical frame of the research study was also built from a thorough review of the main concepts of the study through ERIC and Sage. The findings and the conclusions of the work were interpreted in terms of constructivism approach, and study conducted in the relationship. Figure 1 shows the conceptual basis generating from the literature review, initiating a set of interrelation amid five research concepts: learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude as independent variables that are supposed to impact learning outcomes as the dependent variable.

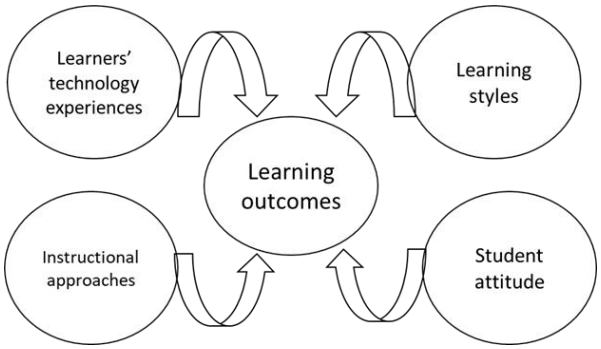

Figure 1. Conceptual foundation

2. LITERATURE REVIEW

Learners' technology experiences, cooperative learning style, student-centered instructional approach, positive student attitude vs learning outcomes. The learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude are likely to influence the learning outcomes. Different authors have done a lot of research to investigate the impact of different variables on the learning outcomes of students at the university. Knowledge delivery modules have been changed to include e-learning nowadays, and based on this indication, Campbell and Monk [14] reported positive results for learner response systems (clickers) to be used as a teaching and learning tool. Furthermore, Ellis [15] suggested that online workload and the integration of the class and online contexts in the blended course were found to be positively related to student achievement. E-learners' engagement and the use of technology could have a tremendous impact on learning outcomes. At the same time, according to Aldhafeeri and Khan [10], self-directed learning readiness and data collection and transformation of learning are positively related to the learning outcomes of students [16]. Hence, it is evidenced that e-learning as an achievement tool is related positively to student achievement. The cited works also show a positive correlation between students' engagement, use of technology, and learning outcomes.

Students' scores are predicted by deep learning approach, as well as by theoretical knowledge and practical skills [17], [18]. Meanwhile, the problem-based learning technique is positively related to learning outcomes [19], [20]. The service-learning, as well as learning the relevant content influenced learning outcomes [21]. At the same time, the experiential pedagogical technique is considered to influence the learning outcomes [22]. Based on Knowles model that include improving learners to achieve learning outcomes, it has resulted that learner-centered approach to teaching and learning are positively related to students' learning outcomes [23]. Students' active participation in different roles as observers, reviewers, and evaluators impacted learning outcomes [24], [25]. However, from another point of view, Lu *et al.* [26]

revealed that "there are no significant differences between students who had learned in high school through autonomous learning and those who learned through teacher-centered approaches." Most of the authors' work cited, except for Lu *et al.* [26], showed that among other techniques deep learning and learning the relevant content predict learning outcomes. "The activities, tasks, functions, and understandings do not exist in isolation but are part of broader systems of relations in which meaning is created"; meantime, according to Wenger [27], "learning implies being involved in new activities, performing new tasks and functions, and mastering new understandings; and students develop skills and attitudes depending on the type of knowledge formation processes in which they participate" [28]. Students' positive attitudes and their nonconformity and heuristic behavior are positively related to learning outcomes [29]. Meanwhile, students' attitudes toward the assignments may positively influence learning outcomes [30]. Thus, students' positive attitudes seemed to influence learning outcomes too. "There is a statistically important difference between student understanding of traditional and web-based experiments" referring to Shyr and Lin [31], and "e-learning environment, and learning application served as robust antecedents to learning outcomes" [32]. Although some previous research revealed that a non conventional learning structure did not indicate online learners' learning. Research by Yusoff *et al.* [33] showed that "while a blended learning approach bears many benefits, it must be tailored to suit the different students' cognitive levels as well as learning styles." Therefore, the previous authors pointed out that e-learning application is a noteworthy predictor of learning progress except the differences between face-to-face learning and blended learning.

Although according to prior research work, there is a linear positive association linking a student's personality and learning style, and indicated that the encoding, imagery, organization, and depth of processing, explained a total of only 20.8% of the variance in learning outcomes. Cuevas and Dawson [34] showed no significant interaction effect between learning style and condition. Study by Nkhoma *et al.* [35] indicated that interactivity positively influenced individual learning performance, but Crowe *et al.* [36] found that "in-class peer review did not indicate student learning achievements." The use of the Q-method, as well as the deep cognitive engagement and motivation, were significant predictors of students' success in their learning performance [37]. Meanwhile, Basak and Yildiz [38] found that "the traditional learning model has found to be more effective than the cooperative learning method in the development of math skills." Learning strategies, as well as the learning environment, and interaction, influenced students' learning progress according to previous research [3], [39]. Hence, the most important conclusion, except for Basak and Yildiz [38] seemed to be that learning strategies and interaction, influenced students' learning outcomes. "Students who participated in the problem-based learning approach earned higher course grades when compared with other students" [40]. The use of student-centered-instructional methods, as well as the instruction of learning strategies, will enhance learning outcomes and strengthen critical thinking skills [41]–[43]. Students' positive attitudes to their previous educational experiences achieved higher results in learning outcomes compared to others [44], [45], as well as students who obtained high emotional support achieved significantly higher scores in their learning outcomes [26], [46].

Thus, the previous authors' work among others pointed out that student-centered-instructional approaches enhance learning outcomes and critical thinking competencies. In conclusion, there is evidence of a positive relationship between learners' technology experiences, cooperative learning style, student-centered instructional approach, positive student attitude influence, and the learning outcomes of students at the university. Hence, to expand the research, as well as to investigate the impact of learners' technology experiences, cooperative learning style, and positive student attitude on learning outcomes it is necessary to further investigate the relationship between variables. Therefore, it is hypothesized that: Learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude predict learning outcomes (H1). A lot of variances in learning outcomes construct may be described by results on these scales.

3. METHOD

The quantitative model is the method used in the research study. Therefore, correlational and regressive tests are used to investigate the research hypothesis. Learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude are considered categorical variables, meanwhile learning outcomes are considered a quantitative continuous variable.

3.1. Instruments and data collection

A structured instrument has been used to gather the primary quantitative data of independent and dependent constructs from subjects. The sections and items of the structured questionnaire are based on learners' technology experiences, cooperative learning style, student-centered instructional approach, positive student attitude, and learning outcomes variables. The selected questionnaire is based on the relevance of the science education (Rose) questionnaire [47], since respondents selected in the study were from science

backgrounds this questionnaire was considered to be one of the appropriate sources to construct the research instrument. Therefore, the Rose questionnaire served as a source for constructing a questionnaire for respondents. The original instrument is characterized by validity and reliability described thoroughly and confirmed by Schreiner and Sjoberg [47]. The structure, as well as the scale of the Rose questionnaire, was considered suitable to gather the data. Referring to the source questionnaire, the researcher adopted a new one. This is because the source' questionnaire does not contain the same variables as the study. The adapted questionnaire instead of 10 dimensions is constructed by five dimensions: i) learners' technology experiences; ii) cooperative learning style; iii) student-centered instructional approach; iv) positive student attitude; v) learning outcomes. Cronbach's alfa values of the adapted instrument scales vary from .87 to .91 validating a very good value of reliability. The adapted questionnaire or questionnaire of the study is piloted using a sample of 30 respondents (N=30), around 10% of the sample of the study. After the piloting process, the questionnaire is improved by restating some items, as well as changing the number of items in some dimensions. Therefore, it is found a high level of internal consistency in the instrument used in the research study, as shown in Table 1. The questionnaire was administered at the end of the first term of the academic year in the period between the two terms.

Table 1. Cronbach's alpha values

No.	Variables	Cronbach alpha value	Evaluation
1	Learners' technology experiences	.89	Good
2	Cooperative learning style	.91	Excellent
3	Student-centered instructional approach	.88	Good
4	Positive student attitude	.87	Good
5	Learning outcomes	.91	Excellent

3.2. Participants

The context of the study population was situated in an important business university. Two faculties of the university were targeted to select the sample of the study: economics and information technology and innovation. These are the oldest faculties of the university and have the largest number of students, so they built a very representative sample. The interested population of the research is the one of sophomore students of three study programs in a large university. From the target population, the cluster random sample of students (N=319), or 15% of accessible population was selected to be used in the study to collect quantitative data. According to previous study [26], a number of 100 respondents or more in quantitative correlational research is a precondition to assure validity and reliability in data collection. Relating to the study program, 89 respondents (28%) studied finance-banking, 131 respondents (41%) for business-administration, and 99 respondents (31%) for information technology and innovation study program. A division of the cluster random sample of students included 222 females (69.6%) and 96 males (30.1%), 279 respondents (87.5%) were 19 years old and 33 respondents were 18 years old (12.5%). Students positively answered the items of the instrument. The respondents were trained before filling in the questionnaires. The respondents were given and clarified the meaning of the variables selected to study. The variables (learners' tech experiences, cooperative learning style, student-centered instruction, positive student attitude, and learning outcomes) were measured at the end of the first term of the academic year.

3.3. Procedure

The measurement of the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude variables was reached based on self-reported instrument. Meantime, the learning outcomes variable was obtained from the student's grades. The data obtained by the instrument were converted in a synthetic way to use as the basis for the analysis of the results. The descriptive procedures, as well as a bivariate correlation test, were used for the processing of data gathered by the instrument. The relationship between learners' technology experiences, cooperative learning style, student-centered instructional approach, positive student attitude, and learning outcomes has been examined using the Pearson correlation measure. A multiple linear regression technique has been used to investigate the prediction of learning outcome levels by learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude. Prior assumption tests have been made to control normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no violations observed.

4. RESULTS

4.1. Descriptive statistics

Referring Table 2, it has been resulted that 22.5% of students reported never or rare level of learners' technology experiences; 62.4% of them reported often or always level, meanwhile, 15.0% of them are neutral. Regards to central tendency score, 319 respondents ranged in levels from 1 to 5, with a mean of 3.69 and a standard deviation of 1.252. As shown in Table 3, 21.6% of students reported a never or rare level of cooperative learning style; 53.6% of them reported often or always level, meanwhile, 24.8% of them were neutral. Making reference to central tendency values, 319 respondents ranged in levels from 1 to 5, with a mean of 3.49 and a standard deviation of 1.251. Table 4 shows that 9.8% of students reported never or rare level of the student-centered instructional approach used in teaching sessions; 76.5% of them reported often or always level and 13.5% of them were neutral. Concerning descriptive scores, 319 respondents ranged in levels from 1 to 5, with a mean of 4.08 and a standard deviation of 1.014.

Table 2. Learners' technology experiences frequencies

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Never	17	5.3	5.3	5.3
	2 Rare	55	17.2	17.2	22.6
	3 Neutral	48	15.0	15.0	37.6
	4 Often	90	28.2	28.2	65.8
	5 Always	109	34.2	34.2	100.0
	Total	319	100.0	100.0	

Table 3. Cooperative learning style frequencies

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Never	29	9.1	9.1	9.1
	2 Rare	40	12.5	12.5	21.6
	3 Neutral	79	24.8	24.8	46.4
	4 Often	89	27.9	27.9	74.3
	5 Always	82	25.7	25.7	100.0
	Total	319	100.0	100.0	

Table 4. Student-centered instructional approach frequencies

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Never	5	1.6	1.6	1.6
	2 Rare	26	8.2	8.2	9.7
	3 Neutral	43	13.5	13.5	23.3
	4 Often	108	33.9	34.0	57.2
	5 Always	136	42.6	42.8	100.0
	Total	318	99.7	100.0	
Missing	System	1	.3		
Total		319	100.0		

As presented in Table 5, 27.3% of students reported a never or rare level of positive student attitude toward teaching and learning; 47.0% of them reported an often or always level; meanwhile, 25.7% of them are neutral. About central tendency scores, 319 respondents ranged in levels from 1 to 5, with a mean of 3.29 and a standard deviation of 1.224. As displayed in Table 6, 19.4% of students reported a very low or low level of learning outcomes; 21.6% of them reported a medium level of learning outcomes, and 59.0% of them reported a high or very high level of learning outcomes. Referring to descriptive statistics, 264 respondents ranged in levels from 1 to 5, with a mean of 3.72 and a standard deviation of 1.227.

Table 5. Positive student attitude frequencies

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Never	29	9.1	9.1	9.1
	2 Rare	58	18.2	18.2	27.3
	3 Neutral	82	25.7	25.7	53.0
	4 Often	90	28.2	28.2	81.2
	5 Always	60	18.8	18.8	100.0
	Total	319	100.0	100.0	

Table 6. Learning outcomes frequencies

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Very low level	14	4.4	4.4	4.4
	2 Low level	48	15.0	15.0	19.4
	3 Medium level	69	21.6	21.6	41.1
	4 High level	71	22.3	22.3	63.3
	5 Very high level	117	36.7	36.7	100.0
	Total	319	100.0	100.0	

4.2. Inferential statistics

As shown in Table 7, there is a relatively low positive relation between learners' technology experiences and learning outcomes variables, r=.328, n=319, p<.005, where increases in learners' technology experiences values were associated with increases in learning outcomes values. There is a medium positive association in the middle of cooperative learning style and learning outcomes variables, r=.485, n=319, p<.005, where increases in cooperative learning style values were linked with increases in learning outcomes values. Meanwhile, there is a relatively low positive correlation in the middle of student-centered instructional approach and learning outcomes (r=.394), as well as between positive student attitude and learning outcomes (r=.329). The total variance of learning outcomes levels as shown in Table 8 explained separately by learners' technology experiences is 5.6%, explained by cooperative learning style is 34.7%, explained by student-centered instructional approach is 23.9%, and explained by positive student attitude is 10.8%.

Table 7. Pearson correlation coefficients

		Correlations				
		Learning outcomes	Learners' technology experiences	Cooperative learning style	Student-centered instructional approach	Positive student attitude
Pearson Correlation	Learning outcomes	1.000	.328	.485	.394	.329
	Learners' technology experiences	.328	1.000	.398	.427	.454
	Cooperative learning style	.485	.398	1.000	.325	.421
	Student-centered instructional approach	.394	.427	.325	1.000	.242
	Positive student attitude	.329	.454	.421	.242	1.000
Sig. (1-tailed)	Learning outcomes	.	.000	.000	.000	.000
	Learners' technology experiences	.000	.	.000	.000	.000
	Cooperative learning style	.000	.000	.	.000	.000
	Student-centered instructional approach	.000	.000	.000	.	.000
	Positive student attitude	.000	.000	.000	.000	.
N	Learning outcomes	318	318	318	318	318
	Learners' technology experiences	318	318	318	318	318
	Cooperative learning style	318	318	318	318	318
	Student-centered instructional approach	318	318	318	318	318
	Positive student attitude	318	318	318	318	318

Table 8. Multiple regression beta coefficients

Coefficients[a]													
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.845	.268		3.160	.002	.319	1.372					
	Learners' technology experiences	.038	.056	.038	.668	.504	-.073	.149	.328	.038	.031	.664	1.505
	Cooperative learning style	.342	.054	.347	6.376	.000	.236	.447	.485	.339	.299	.745	1.343
	Student-centered instructional approach	.289	.064	.239	4.522	.000	.163	.415	.394	.248	.212	.789	1.268
	Positive student attitude	.108	.055	.108	1.960	.051	.000	.217	.329	.110	.092	.725	1.379

a. Dependent variable: Learning outcomes

5. DISCUSSION

The purpose of the research was to study the relation between the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude toward learning outcomes. The prior assumption was that the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude impact learning outcomes. The results show that learners' technology experiences existed almost always or often among students, cooperative learning style most often or always, a student-centered instructional approach often or always, and a positive student attitude most often or always. This result means that students reported mostly always often level of learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude. Therefore, there is a significant level of learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude of students at the university. Hence, according to students' perceptions, learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude are present at a considerably high scale during teaching and learning activities at the university. Meantime, the results showed that learning outcomes are mostly at a high or very high level among university students. This result means that students reported learning progress mostly at a high or very high level as university students. Thus, there is an important level of the learning achievement of students. Hence, learning outcomes appear to be at a high or very high level, according to students' perceptions. Apart from that, faculties and lecturers should support the students to increase further learners' technology experiences values, promote a cooperative learning style and positive student attitude, as well as to use a significant student-centered model to keep up learning outcomes.

It is found a relatively low positive association in the middle of learners' technology experiences and learning outcomes variables (r=.328), and a medium positive relationship between cooperative learning style and learning outcomes variables (r=.485). Therefore, high scores of learners' technology experiences are associated with high scores of learning progress, and cooperative learning style values are associated with learning outcomes values. Meanwhile, the study found a relatively low positive correlation between student-centered instructional approach and learning outcomes (r=.394), as well as between positive student attitude and learning outcomes (r=.329). Therefore, high scores of student-centered instructional approach are associated with high scores of learning outcomes, and high scores of positive student attitude are associated with high scores of learning outcomes. These results confirm the positive relationship between learners' technology experiences, cooperative learning style, student-centered instructional approach, positive student attitude, and learning outcomes.

The study revealed that the variance of learning outcome levels described by learners' technology experiences is 5.6%; by cooperative learning style is 34.7%, by student-centered instructional approach is 23.9%, and by positive student attitude is 10.8%. This indicates that cooperative learning and student-centered instructional approach influence strongly learning outcomes. Therefore, the cooperative learning style and the student-centered instructional approach are making a great positive contribution to the prediction of learning outcomes. Meanwhile, the learners' technology experiences and positive student attitudes are making a moderate positive indication to the prediction of learning outcomes. This is an important result confirming that cooperative learning and the student-centered instructional approach influence strongly learning outcomes.

The study results were in line with previously research, which showed that student-centered teaching approach and problem-based learning predict academic achievement [3], [24], [26], [31], [32], [34], [38], [40], [41], [44], [46], [48]. Therefore, the hypothesis (H1) was supported. A lot of variances in learning outcomes may be described by scores on these scales, which is supported. Hence, departments and lecturers should promote cooperative learning styles and should use a more student-centered instructional approach, as important predicting variables of learning outcomes.

6. CONCLUSION

One main limitation of the study should be emphasized as part of the conclusions. The measurement of the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude has been made referring to self-reported items. The measurement of them has been made using the structured questionnaire and this is the limitation. Meanwhile, the measurement of the learning outcomes was referred to the registry of students' grades, which is a reliable source. In general, the findings of this study strengthen theoretical and practical understanding as the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude are important variables that impact learning outcomes.

The outcomes of the study, enhanced by other authors about the impact of the learners' technology experiences, cooperative learning style, student-centered instructional approach, and positive student attitude

in learning outcomes have dominant involvement for future research. Such research should investigate the influence of other variables on learning outcomes. Other studies may include prior knowledge, curricula, class management, learning styles, class interaction, lecturer support, and school climate. The results of this study also have important connotations for practice. Different formats and other interventions that include cooperative learning, student-centered instructional approach, and learning outcomes, but not only should be designed by departments based on the results of the study to develop and support students. At the same time, lecturers should refer to the results in their work, especially the student-centered instructional approach during the teaching and other activities to support students and their academic results. The students should acknowledge that cooperative learning influence strongly their learning outcomes. These recommendations are based on the results of the study that confirmed that cooperative learning and student-centered instructional approach especially influence strongly learning outcomes.

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