

INTERPLAY BETWEEN COGNITIVE STYLES AND GENDER OF TWO HYBRID LEARNING TO LEARNING ACHIEVEMENTS

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ABSTRACT

Hybrid learning is an education model that blends F2F (face-to-face) and online lessons. Each learning model can determine individual students to succeed or fail. The mixing combination in mixed learning affects the pedagogical results. The problem is how the pedagogical results are due to students' cognitive styles, gender, and the mixed level of hybrid learning. So that the questions are: how effective is the hybrid learning with a mixture of 60% F2F and 40% online; how the interplay results between cognitive styles and genders affect learning achievements; and what are the distinctions in learning achievement of this hybrid learning with a mixture of 60% F2F lesson and 40% online lesson compared to prior hybrid learning with a blend of 40% F2F lesson and 60% online lesson. This research objective compares the interplay results between the cognitive styles and the gender of the two-hybrid learning. The research method is experimental. The research discloses that: hybrid learning with a mixture of 60% F2F and 40% online is a good study result; there are differences in learning achievement between student cognitive styles and student gender; male students with visual cognitive style are more successful in learning achievement. Hybrid learning combined with online teaching materials 20% greater than F2F teaching materials shows more successful learning outcomes. This research novelty is that students' cognitive style and gender interact and have different effects on hybrid learning achievement. The contribution of this research is that in learning, it is necessary to pay attention to the learning model used and the media to support students' cognitive styles in achieving better effectiveness of learning outcomes.

Keywords: *Interplay, Cognitive style, Gender, Hybrid learning, Learning achievement*

1. INTRODUCTION

The three main learning models are F2F, online, and hybrid learning. The hybrid learning model is a composite lesson of F2F and online, where the delivery of teaching material taught is partly F2F and partly online. In F2F learning, the direct interaction between students and instructors (lecturers) occurs in the lesson process. Whereas in online education, instructors or subject matter and students are in different locations, and the interaction of the learning process takes place via the internet or known as distance learning (Anggrawan and Satria, 2020). Each learning model has advantages behind its

shortcomings in achieving cognitive area learning results for students. So, it is essential to pay attention to students' cognitive styles [1]. It is also necessary to consider the learning model to achieve better learning results [1]. The F2F lesson model is superior to students' affective aspects which students can engage F2F directly with each other in learning and relationships. Meanwhile, the demand for online education is increasing rapidly, which impacts the pressure on the use of online resources [2]. The success of online learning depends on its use and its influence on the learner [3]; the online learning model is superior in the cognitive aspect of independent learning, which can repeat any learning material anywhere, any time, and



in any environment [4][5]. In other words, in study online learning, students do not need it anymore physically present on campus [2]. Online education positively impacts productivity, effectiveness, and efficiency in learning [3]. Previous research indicates that online learning provides better cognitive learning results than those taught by F2F class [6]. Moreover, based on previous research, online information sources' utilization increases student learning achievement [7]. However, some experts suggest learning solutions with hybrid learning, a learning concept used to integrate various activities [8].

Hybrid learning is an excellent solution because it adopts the prime advantages from F2F class and online study, facilitating learning using information technology while preserving experience in a classroom environment [9][10]. As mentioned by Simonson et al., the best of both worlds is hybrid learning [4] because, after all, hybrid learning supports students to study in a F2F environment in the class lesson and to study online independently [11]. What is more, lately, the online-based study's demand has increased rapidly to facilitate various cognitive styles and study environments [12]. In short, hybrid learning is a study solution by using Information and Communication Technology-based online study combined with traditional classroom activities [13]. Hybrid learning will be a standard and expected method in delivering teaching [14].

Cognitive style shows learning preference or the way students prefer and is typical behavior of students who tend not to change [15]. Cognitive style is also how a person begins to concentrate, process, analyze, and memorize new academic information [16]. Students with visual preferences show a tendency for more outstanding capabilities in analyzing and integrating visual communication. Students with auditory cognitive styles prefer to manage information conveyed through conversation or voice. Kinesthetic students tend to collect information by touch, such as interactive media [17]. Each study model and study media can deliver certain students to succeed or fail, but that does not mean the same applies to other students. Students have an individual dominant cognitive style. According to the students' cognitive style, students have an environment and learning media if the learning model facilitates their cognitive style. Visual experience constitutes the dominant factor when students learn to digest study material and interact with the environment. Fortunately, online teaching provides a different study experience and

also supports a variety of student cognitive styles [18]. So, student study results' success is closely related to learning models and media and the cognitive styles that students have themselves.

The subject of Algorithms and Programming is the primary skill lesson in the informatics engineering study program. Studying Algorithms and Programming is relatively not straightforward [19] because it involves understanding theoretical, instruction declarations, algorithmic skills [19], and computer programming logic. The toughest challenges and problems when studying Algorithms and Programming are cognitive competencies, which are logical abilities to understand algorithms and solve programming problems into algorithms or flowcharts [20]. That is why it is no secret that in studying Algorithms and Programming of traditional F2F study, most students have failed to solve programming problems or have difficulties solving programming problems to be algorithms. Thus, it is necessary to realize effective study pedagogy to study programming for students [19], which helps students become more competent in Algorithms and Programming lessons. However, hybrid learning helps overcome challenges and problems when studying algorithms or programming [21].

Statistically, there is no difference in the study components, motivation beliefs, and learning achievement in the online independent learning environment by gender [22]. Women in online study appreciate the opportunity to interact with other students rather than men [23]. Women are more enthusiastic in online education [23], but whereas virtual presentations are offline, men are more active in accessing lessons than women [24]. Because male and female genders have different interactions, spirits, and interests in the study, so logically, male and female gender students' interest in Algorithms and Programming lessons can be distinct. In other words, the achievement of Algorithm and Programming learning outcomes between genders can differ in their learning success depending on the learning method used.

Creating hybrid learning and determining the right mix is not easy, particularly in developing interactions that meet traditional programs' same standards [13]. According to Elaine Allen, Jeff Seaman, and Richard Garrett, an excellent blend of hybrid learning is if the online mixing level is between 30% to 79% [25]. In another case, referring to Agosto et al. opinion, to obtain an excellent mix for hybrid learning is trial and error [9].

The level of mixing between F2F and online



education in hybrid learning will change over time and will vary from one lesson to another [14]. The experiment conducted in this hybrid learning was a composite of 60% versus 40% of F2F and online lesson materials.

The previous finding in a hybrid study by the author with a learning mix of 40% F2F and 60% online confirmed that different study results occurred for students who possessed different cognitive styles. Generally, male students achieved success in learning better than female students [26]. Besides, referring to previous findings, male students with visual cognitive styles are superior to all students with other cognitive styles who have kinesthetic and auditory cognitive styles [26]. Previous research by the author also found that an interplay occurred between cognitive styles and genders on students learning achievement [26]. In other words, the student learning achievement in hybrid learning is not only influenced by the study model but also influenced by student cognitive style, gender, and the hybrid level of online and F2F studies. However, the questions are: How good is learning achievement in hybrid learning with a varied group of 60% F2F and 40% online and its relationship to the interplay of students' cognitive and gender styles?; How does the comparison or what are the differences in the results of interplays between cognitive styles and genders that occur in hybrid learning with mixing of 60% F2F and 40% online in this study compared with the previous research with a mix rate of 40% F2F and 60% online? This study provides answers. In other words, this study's main objective is to compare the interplay between the cognitive styles and the gender of the two-hybrid learning.

Thus, the research questions are 1). in connection with this study, research questions related to hybrid learning with a mixing level of 60% F2F and 40% online teaching: (a). Does hybrid learning with 60% F2F teaching materials and 40% online teaching materials provide good study results?; (b). Are there interplays between cognitive style and gender in hybrid learning by delivering 60% F2F teaching materials and 40% online teaching materials?; (c). Are there differences in learning success of hybrid education with a mixture of 60% F2F subject matter and 40% online subject matter between students' different genders?; (d). Are there differences in learning success in hybrid education with a mixture of 60% F2F subject matter and 40% online subject matter between the student of different genders? 2). in connection with

comparing the results of this study (hybrid learning studies with a mixture of teaching materials 60% F2F and 40% online) with previous research results (hybrid learning lessons with a blend of teaching materials 40% F2F and 60% online): how does the comparison of cognitive styles and gender interact between the two Hybrid learning: hybrid learning of this study (with teaching material delivered 60% F2F and 40% online) compared to prior research (with teaching material provided 40% F2F and 60% online)?.

In short, this study just focuses on discussing and solving research questions related to hybrid learning with a mixing level of 60% F2F and 40% online teaching and comparing the results with previous research (hybrid learning lessons with a blend of teaching materials 40% F2F. and 60% online).

2. RELATED WORK

This subsection provides an overview of some related works from the latest scientific articles regarding the methodology and contributions made and their weaknesses or strengths compared to this research conducted.

- M. J. Kintu, C. Zhu, and E. Kagambe (2017) examined the effectiveness of the hybrid learning surrounding by testing the correlation between students' background and hybrid learning pattern on student lesson achievement. This study used a survey method. It contributed to the fact that students' characteristics and design feature determined hybrid learning success [27]. This previous study does not consider the influence of students' cognitive styles, gender differences, and the blend of F2F material mixtures and an online lesson in hybrid learning, as was done in this study.
- T. I. Oweis (2018) examines the effect of hybrid learning on learning success and student motivation in learning English [28]. This previous research method is no different from the research method in this article which is experimental research. This prior study looked at differences in learning achievement and student enthusiasm for F2F learning and hybrid learning. In contrast, this article's study looked at the interplay between cognitive style and gender of two hybrid learning on learning achievement.
- Cimermanova (2018) examined whether there was an interaction between students' cognitive styles and F2F and online teaching forms [29]. Previous research is different from the research in this article, which examines the interaction between cognitive style and gender in two hybrid



learning and examines the effect of interactions between cognitive style and gender with hybrid learning methods

- N. R. Alsalihi, M. E. Eltahir, and S. S. Alqatawneh (2019) examined student achievement differences in hybrid learning and F2F learning and tested students' attitudes towards learning methods [30]. This previous research looked at students' attitudes towards the learning methods. Meanwhile, this article's analysis looked at the influence of cognitive styles on learning achievement in hybrid learning. This previous study's shortcomings do not explain the percentage of mixing in hybrid learning between F2F and online learning materials, as in this article's research. This prior study is the same as the research in this article as experimental research.
- Anggrawan et al. (2019) conducted experimental research on hybrid learning with a blend of 40% F2F learning material and 60% online learning material for Algorithm and Programming courses [26]. In contrast, this article's research conducted experimental research on hybrid learning with a mixture of 60% F2F learning material and 40% online learning material for the Algorithm and Programming course and compared it with the previous research.
- O. O. Ola Baju (2020), in his research, concluded that students' cognitive style and gender are predictor components that contribute to the success of F2F English learning [31]. The weakness of previous research is that it only predicts that students' cognitive style and gender have an effect on learning achievement. Meanwhile, the study conducted in this article examines which cognitive style and gender influence student achievement. This previous research method was descriptive survey research, whereas the research conducted in this article was an experimental study in two-hybrid learning.

Referring to the elaboration of the latest related work by several researchers, in essence, this research article is a new study with hybrid learning material that no other researcher has examined before. Besides, this article's authors compared the learning outcomes obtained with previous studies with the opposite mixture of teaching materials, which other authors had never conducted before.

3. RESEARCH METHOD

The research conducted was an experimental study. In this experimental study, hybrid learning received hybrid subject matter treatment with a learning ratio of 60% versus 40% between F2F classroom lesson and online asynchronous independent lesson. The advantage of this article's research is to analyze and compare the results achieved with the results achieved in previous hybrid learning studies, which combine mixed learning between F2F and asynchronous online classes that are different from the hybrid varieties in this study.

3.1 Population and Treatment

This study population was the first semester students of the 2018/2019 academic year of the computer science study program at Bumigora University in Indonesia. The total student population is 250 students. There are five classes, each consisting of fifty students drawn randomly from the student population. The class that is the experimental research class is a randomly selected class from the five existing classes. Some experts argued that 30% to 79% of the online mixing rate is the best blending in hybrid learning [24], while others said that an excellent hybrid learning mix is obtained through trial and error [6]. Therefore this study conducted a research experiment using a mixture of 60% F2F lessons and 40% online lessons. Students in this hybrid learning receive a F2F class of Algorithm and programming lessons that last for half a semester. On the other hand, for online learning, students learn independently in online asynchronous teaching materials modules provided in the MOODLE Learning Management System.

3.2 Data Collection Procedure

The data collected includes study results of cognitive styles and gender possessed by each student. The learning outcomes instrument used to manage student learning outcomes data were multiple-choice questions (for quizzes) and descriptions (for midterm and final exams) that had passed the validity and reliability tests. The questionnaire conducted in the hybrid learning class using the standard VARK cognitive style instrument (Visual, Auditory, Reading / Writing, Kinesthetic) was to identify students' cognitive styles. An attempt to determine the gender of students participating in hybrid learning is to identify new students from the electronic form entry data.

3.3 Test Method and Research Hypothesis

The data in this research are data ratios, and the research was conducted on samples so that this research method constitutes quantitative inferential research. This research method is an experimental study based on the particular treatment carried out on the sample data studied. Therefore the criteria for analysis in this study are descriptive analysis and parametric inferential analysis.

Instrument validity and reliability and data normality and homogeneity have been carried out statistical tests with Pearson correlation, Cronbach's alpha, Shapiro-Wilk, and Levene.

The descriptive test using the 1 sample t-test determines whether hybrid learning achievement is greater or equal to 60% of the ideal value. Meanwhile, the inferential parametric test includes a two-way ANOVA test, an independent 2-sample t-test, and Scheffe test. The two-way ANOVA test conducted in this study was to ascertain: whether there was an interplay between students' cognitive styles and gender on hybrid learning achievements; are there differences in learning achievements due to the influence of students' cognitive styles; and are there differences in learning achievements between students who are male and female gender. The comparative test using the independent 2-sample t-test is to compare the results of hybrid learning between male and female students. Meanwhile, to analyze the interaction between cognitive style and student gender is to use the Scheffe test.

So, by referring to the research question, the research hypothesis (H) in the Algorithm and Programming subject is as follows:

- 1). There are four hypotheses for the results of this study (hybrid learning with a mixture of 60% F2F and 40% online teaching materials), which are as follows:
 - H1: The study result of hybrid learning is more excellent than 60% of the ideal value.
 - H2: Interplay occurs between student cognitive style and student gender difference on study results.
 - H3: There are different study results between male and female genders.
 - H4: There are different study results of students who have cognitive style distinction;
- 2). There is one hypothesis to test the relationship between the results of this study compared to the effects of previous studies (hybrid learning with a mixture of 40% F2F and 60% online teaching materials), which is as follows:

H5: There is a difference in learning achievements between the interplay of cognitive and gender styles of the two-hybrid lessons being compared, namely hybrid learning with teaching material delivered with a mix of 60% F2F and 40% online from previous research, and teaching materials delivered with a blend of 40% F2F and 60% online.

Actions taken to prevent threats to internal validity are as follows: Hybrid learning students have the same background as new high school graduates so that students have equal initial cognitive abilities in the essential competencies of Algorithm and Programming, thus can preventing the occurrence of threats of internal validity in the form of mortality or friction; This research involves a F2F study control group as part of hybrid learning, thus threatening internal validity of historical was prevented; this research uses standard instrumentation; The non-standard research instrument used has passed the validity and reliability test so that this study is free from the threat of the validity of the internal instrumentation; Besides that, a pretest was carried out with a relatively long period with posttest (around three months) so that students did not remember the pretest questions so that the threat of pretest testing internal validity did not occur in this research.

Actions taken to prevent external validity threats are as follows: Other lecturers (not researchers) did the teaching in this study, so no bias or researchers did not affect learning outcomes, whether intentional or unintentional. The hybrid learning classroom sample is a random sample of the student population so that the threat of treatment-selection interactions does not occur. The threat of external validity for reactive effects does not happen because hybrid learning is a new learning model for students; besides, the lecturer prevents students from knowing the purpose of the research. External validity threat for diffusion treatment does not happen because hybrid learning students are not aware of any research on learning outcomes. Students receive only one experimental therapy so that no interactions occur before and after treatments, so it prevents the threat of repeated treatment interruptions.

4. RESULTS AND DISCUSSION

The survey results using the VARK instrument indicate that 25 students have auditory cognitive styles, ten students who have kinesthetic cognitive styles, and 15 students who possess visual cognitive styles, as shown in table 1. Table 2



describes the frequency distribution based on students' gender in this research. There are 30 male students and 20 female students

Table 1. Frequency Distribution of Student Cognitive Style

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Auditory	25	50.0	50.0	50.0
	Kinesthetic	10	20.0	20.0	70.0
	Visual	15	30.0	30.0	100.0
	Total	50	100.0	100.0	

Table 2. Frequency Distribution of Student Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	20	40.0	40.0	40.0
	Male	30	60.0	60.0	100.0
	Total	50	100.0	100.0	

The Pearson correlation coefficients of the validity test of learning outcomes instruments (quiz, midterm, and exam) were 0.492, 0.692, and 0.619 (table 3), which conclude that the instruments used to measure study results have high validity. While the result of the reliability test of study results instruments with Cronbach's-Alpha was 0.535 (table 4), which shows the study results items have good internal consistency, or instruments to measure study results used to have good reliability.

Table 3. The Validity Test of the Study Result Instrument with Pearson Correlation

		Quiz	Midterm	Exam	Score Total
Quiz	Pearson Correlation.	1	.260	.253	.492**
	Sig. (2-tailed).		.068	.077	.000
	N.	50	50	50	50
Midterm	Pearson Correlation.	.260	1	.326*	.692**
	Sig. (2-tailed)	.068		.021	.000
	N.	50	50	50	50
Exam	Pearson Correlation.	.253	.326*	1	.619**
	Sig. (2-tailed)	.077	.021		.000
	N.	50	50	50	50
Score Total	Pearson Correlation.	.492**	.692**	.619**	1
	Sig. (2-tailed)	.000	.000	.000	
	N.	50	50	50	50

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 4. The Reliability Test of The Study Results with Cronbach's Alpha

Cronbach's Alpha	N of Items
.535	3

The significance value of Levene test for the midterm study result of this research was

0.173, and the final test is 0.558, which is higher than the alpha value of 0.05 (as shown in table 5). It concludes that the variance of student data on male and female genders is homogeneous.

Table 5. The Result of Homogeneity test

	Levene Statistic	Df1	Df2	Sig.
Midterm	1.910	1	48	.173
Exam	.348	1	48	.558

Normality test towards study results data with Shapiro-Wilk shows that the significant value of male's gender was 0.588 and women's gender was 0.462 (as shown in table 6). The two gender groups' significant values are greater than 0.05 of the alpha value 0.05, so the study results for both gender groups are normally distributed.

Table 6. The Result of Normality Test

	Gender	Kolmogorov-smirnov		Shapiro-wilk			
		Statistic	Df	Statistic	Df	Sig.	
Score	Male	.087	30	.200*	.972	30	.588
Total	Female	.149	20	.200*	.956	20	.462

Based on the one-sample t-test results (on table 7 and table 8): The average score of student study results taught with hybrid learning in this research was 63.66, t-test significance value was 0.00 that is lower than alpha value 0.05, and the t value in one sample t-test in hybrid learning was positive (39.170), this indicates that the composite learning result is more than 60% of the ideal value. So, the H1 research hypothesis is accepted. In other words, the hybrid learning model with a mixture of teaching subject matter of 60% F2F and 40% online produces a relatively good study result in Algorithms and Programming lesson.

Table 7. Mean Score of One Sample T-test

	N	Mean	Std. Deviation	Std. Error Mean
ScoreB2VAK	50	63.66	6.076	.859

Table 8. Significant Value of One Sample T-test

	TestValue=30				95% Confidence Interval of the Difference	
	T	df	Sig.(2-tailed)	Mean Difference	Lower	Upper
ScoreB2VAK	39.170	49	.000	33.660	31.93	35.39

The two-way Anova test showed that the significant interplay value of gender and cognitive style (0.018) was lower than the alpha value (0.05), as shown in table 9. It means that there was an interplay of gender and cognitive style. In other words, student gender and student cognitive styles influenced the study results of the Algorithms and Programming lesson on hybrid learning. Hence, the H2 research hypothesis is accepted that the interplay



occurs between student cognitive style and gender difference on study results. Furthermore, by referring to Anova test, It is also known that gender differences affect the results of the hybrid study because the significance value of the Anova test is 0.01 or less than 0.05 than the alpha value. In other words, there are differences in study results between the sexes of men and women, or the H3 research hypothesis is accepted. Likewise, student cognitive styles influence hybrid learning results because the Anova test shows a significant value of cognitive style 0.037 lower than alpha value 0.05. This confirms the occurrence of differences in student learning results with distinct cognitive styles, or the research hypothesis of H4 is failed to be rejected.

Table 9. Two-way Anova Test

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	750.912 ^a	5	150.182	6.244	.000
Intercept	146176.191	1	146176.191	6077.394	.000
GenderVAK	176.183	1	176.183	7.325	.010
VAKB2	170.585	2	85.293	3.546	.037
GenderVAK*VAKB2	210.643	2	105.322	4.379	.018
Error	1058.308	44	24.052		
Total	204439.000	50			
Corrected Total	1809.220	59			

a. R Squared = .414 (Adjusted R Squared = .349)

The independent sample t-test shows a significant 2-tailed value (0.001), as shown in table 11, which was lower than 0.05, which indicates study results between gender diversity are different. Due to the average value of male student study results is 65.87 and the average value of female student study results is 60.35, as shown in Table 10, the conclusions obtained are students with male gender more successful in the study than students with the female gender. This ascertains that the H4 research hypothesis is failed to reject, or there are distinctions in hybrid learning results of 60% F2F and 40% online due to gender differences.

Table 10. The Average Study Results Based on Gender

	Gender	N	Mean	Std. deviation	Std. error Mean
ScoreB2VAK	Male	30	65.87	5.218	.953
	Female	20	60.35	5.869	1.312

Post-Hoc Scheffe test results for hybrid learning with a hybrid level of 60% F2F and 40% online, as shown in Table 12, revealed what is the distinction between study achievement in hybrid learning with mixing 60% F2F and 40% online viewed from gender and cognitive style of students: (a). Auditory cognitive style students with female gender attain lower learning

attainment than visual cognitive style students with male gender and kinesthetic cognitive style students with female gender, but do not differ in learning attainment than other cognitive style students; (b). Auditory cognitive style students with male gender do not differ in learning attainment than other cognitive style students; (c). Kinesthetic cognitive style students with female gender attain better learning results than auditory cognitive style students with female gender, but do not differ in learning attainment than other cognitive style students; (d). Kinesthetic cognitive style students with male gender and visual cognitive style with female gender do not differ in learning attainment than other cognitive style students; (e). Visual cognitive style students with male gender attain better study results than auditory cognitive style students with female gender but do not distinct in learning attainment than other students' cognitive styles.

Table 11. T-test Towards Learning Results Based on Gender

	Levene's Test for Equality of Variances	t-test for Equality of Means										
		F		Sig.		T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	Lower	Upper							
ScoreB2VAK	Equal variances assumed	.002	.966	3.484	48	.001	5.517	1.583	2.333	8.700		
	Equal variances not assumed			3.302	37.477	.002	5.517	1.622	2.232	8.801		

Table 12. Multiple Comparison of Post-Hoc Scheffe of Learning Results of Hybrid Learning with Mix Level of 60% F2F and 40% Online

(I)InteractionVAK	(J)InteractionVAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-5.06	1.913	.242	-11.73	1.60
	KFemale	-11.23*	3.061	.033	-21.89	-.57
	KMale	-5.52	2.240	.319	-13.32	2.29
	VFemale	1.10	3.061	1.000	-9.56	11.76
	Vmale	-9.56*	1.913	.001	-16.23	-2.90
Amale	Afemale	5.06	1.913	.242	-1.60	11.73
	KFemale	-6.17	3.085	.556	-16.91	4.58
	KMale	-4.5	2.273	1.000	-8.37	7.46
	VFemale	6.17	3.085	.556	-4.58	16.91
	Vmale	-4.50	1.951	.393	-11.30	2.30
Kfemale	Afemale	11.23*	3.061	.033	-.57	21.89
	AMale	6.17	3.085	.556	-4.58	16.91
	KMale	5.71	3.298	.700	-5.77	17.20
	VFemale	12.33	3.902	.098	-1.26	25.93
	Vmale	1.67	3.085	.998	-9.08	12.41
Kmale	Afemale	5.52	2.240	.319	-2.29	13.32
	AMale	4.5	2.273	1.000	-7.46	8.37
	Kmale	-5.71	3.298	.700	-17.20	5.77
	VFemale	6.62	3.298	.552	-4.87	18.11
	Vmale	-4.05	2.273	.675	-11.96	3.87
Vfemale	Afemale	-1.10	3.061	1.000	-11.76	9.56
	AMale	-6.17	3.085	.556	-16.91	4.58
	KMale	-12.33	3.902	.098	-25.93	1.26
	VFemale	-6.62	3.298	.552	-18.11	4.87
	Vmale	-10.67	3.085	.053	-21.41	.08
Vmale	Afemale	9.56*	1.913	.001	2.90	16.23
	AMale	4.50	1.951	.393	-2.30	11.30
	KMale	-1.67	3.085	.998	-12.41	9.08
	VFemale	4.05	2.273	.675	-3.87	11.96
	Vmale	10.67	3.085	.053	-.08	21.41



In previous offline learning findings, men were more active in accessing lessons with visual presentations than women [25]. In comparison, this study about hybrid learning combining 60% F2F and 40% online found that men who prefer visual presentation are more successful than women who like a voice presentation. The Scheffe test results of the previous study for hybrid learning with a hybrid level of 60% F2F and 40% online are shown in table 13. Learning outcomes due to the interplay between cognitive style and gender of two hybrid lessons with a hybrid rate of 60% F2F and 40% online are as shown in table 12, and hybrid learning with a varied level of 40% F2F, and 60% online is as shown in table 13. In the two-hybrid learning models taught with a mixture of 60% F2F and 40% online and a mixture of 40% F2F and 60% online, there is no difference in student achievement, except for students who have a visual cognitive style and are males.

Students with a visual cognitive style with male gender who are taught with hybrid learning with a mix of 40% F2F and 60% online have superior learning results compared to those conducted with hybrid learning with a composite of 60% F2F and 40% online. Thus, the H5 research hypothesis is accepted.

This study finding confirms that hybrid learning in Algorithm and Programming learning with a combination of 60% F2F and 40% online is a good combination in hybrid learning. Besides, in hybrid learning, the variety of online learning materials that is 20% greater than F2F learning material provides superior learning achievement. Thus the results of this study can be a reference to participate in mediating conflicts/arguments about how many combinations in hybrid learning can produce superior learning achievement. Furthermore, this study answers the difference in the magnitude of the influence of student cognitive style and male or female gender on student achievement in two-hybrid learning that has not been revealed in previous related works.

5. CONCLUSION

The conclusions of this research result are: (a), the hybrid learning with combination level of 60% F2F and 40% online offers good study result (or effective learning) and can be an alternative learning model; (b), the interplay occurs between gender and cognitive styles towards study results, this indicates that gender and cognitive styles of students together influence the study results; (c), study results between gender diversity are different: students with male gender are more successful in study than students with female gender; (d), there are differences study results of students that have distinct cognitive styles in hybrid learning with combination learning of 60% F2F and 40% online; (e), hybrid learning with the mixture of teaching materials by 40% versus 60% compared to the mixture of teaching materials by 60% versus 40% between learning of F2F and online shows that hybrid learning with greater online learning achieves better learning results especially for students that have visual learning styles.

The novelty of this research findings are:

- (a) The cognitive style and gender of students interact and have different effects on hybrid learning achievement;
- (b) It is necessary to pay attention to selecting an appropriate learning model in learning and pay attention to media use that supports all student cognitive styles to achieve better learning success.

Table 13. Multiple Comparison of Post-Hoc Scheefe of Learning Results of Hybrid Learning with Mix Level of 40% F2F and 60% Online

(I) Intsninteraction VAK	(J) Interaction VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-3.92	2.340	.289	-14.08	2.24
	KFemale	-3.25	3.242	.960	-14.56	8.06
	KMale	1.00	3.009	1.000	-9.49	11.49
	VFemale	-7.20	3.009	.352	-17.69	3.29
	Vmale	-16.54*	2.340	.000	-24.70	-8.38
Amale	Afemale	5.92	2.340	.289	-2.24	14.08
	KFemale	2.67	3.085	.979	-8.08	13.43
	KMale	6.92	2.839	.330	-2.98	16.82
	VFemale	-1.28	2.839	.999	-11.18	8.62
	Vmale	-10.62*	2.116	.001	-18.00	-3.24
Kfemale	Afemale	3.25	3.242	.960	-8.06	14.56
	AMale	-2.67	3.085	.979	-13.43	8.08
	KMale	4.25	3.619	.924	-8.37	16.87
	VFemale	-3.95	3.619	.943	-16.57	8.67
	Vmale	-13.29*	3.085	.007	-24.05	-2.53
Kmale	Afemale	-1.00	3.009	1.000	-11.49	9.49
	AMale	-6.92	2.839	.330	-16.82	2.98
	KMale	-4.25	3.619	.924	-16.87	8.37
	VFemale	-8.20	3.412	.347	-20.10	3.70
	Vmale	-17.34*	2.839	.000	-27.44	-7.64
Vfemale	Afemale	7.20	3.009	.352	-3.29	17.69
	AMale	1.28	2.839	.999	-8.62	11.18
	KMale	3.95	3.619	.943	-8.67	16.57
	VFemale	8.20	3.412	.347	-3.70	20.10
	Vmale	-9.34	2.839	.076	-19.24	-.56
Vmale	Afemale	16.34*	2.340	.000	8.38	24.70
	AMale	10.62*	2.116	.001	3.24	18.00
	KMale	13.29*	3.085	.007	2.53	24.05
	VFemale	17.34*	2.839	.000	7.64	27.44
	Vmale	9.34	2.839	.076	-.56	19.24

*. The mean difference is significant at the 0.05 level.

This research and previous study findings by authors reinforce the saying that the eye is a window to the world because students with visual cognitive styles (relying on vision) are more dominant in learning achievement than hybrid learning.

This study only examines the linkage of 60% hybrid learning material F2F and 40% asynchronous online learning material with cognitive style and student gender in influencing learning achievement and comparing it with

previous research with the mixture of 40% F2F learning material and 60% online asynchronous learning material for the Algorithm and Programming course. Likewise, previous research has limitations behind the advantages possessed as in this study. Therefore for future research, it is necessary:

- (a) to do the study on hybrid learning with other different mix levels so that it can find out the best and worst mixture in achieving composite learning outcomes for specific subjects;
- (b) to do a comparative study of various other existing learning models such as case-based learning, self-regulated learning, and collaborative learning, so that finally, the actual knowledge of learning patterns that are best for specific subjects is ultimately gained and other moderator variables besides gender and cognitive style.

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