

Similarity_Jatit_Interplay Between Cognitive Styles and Gender of 2 Blended Learning to Learning Achievements

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

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5 ABSTRACT

Blended learning is a learning model that mixes face-to-face and online learning. Each learning model can determine individual students to succeed or fail. The mix combination in blended learning affects the pedagogical results. The questions are: how effective is the blended learning with a mixture of 60% face-to-face and 40% online; how the interplay results between cognitive styles and genders affect learning achievements; and what are the distinctions in learning achievement of blended learning study with a mixture of 60% face-to-face learning and 40% online compared to prior mixed learning study with a blend of 40% face-to-face and 60% online. This research objective compares the interplay results between the cognitive styles and the gender of the two-blended lessons. The research method is experimental. The research discloses that: blended learning with a mixture of 60% face-to-face and 40% online is a good learning 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. Blended learning with a combination of online teaching materials 20% greater than face-to-face teaching materials shows more successful learning outcomes. This study's favorable implication is that this study confirms that the mix of teaching materials and learning media is a primary component in determining achievement in blended learning.

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

1. INTRODUCTION

The three main models of learning are face-to-face, online, and blended learning. The blended learning model is a composite lesson of face-to-face and online, where the delivery of teaching material taught is partly face-to-face and partly online. In face-to-face 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 face-to-face learning model is superior to students' affective aspects which students can engage face-to-face 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 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 face-to-face class [6]. Moreover, based on previous research, online information sources' utilization increases student learning achievement [7]. However, some experts suggest learning solutions with blended learning, a learning concept used to integrate various activities [8].

Blended learning is an excellent solution because it adopts the prime advantages from face-to-face class and online study, including facilitating studies using information technology while preserving experience in a classroom environment [9][10]. As quoted by Simonson et al., the best of both worlds is blended learning [4] because, after all, blended learning supports students to study in a face-to-face 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, blended learning is a study solution by using Information and Communication Technology-based online study combined with traditional classroom activities [13]. Blended 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, the success of student study results is closely related to learning models and media and the cognitive styles that students have themselves.

The algorithms and Programming subject is one of the main skill subjects in the computer science 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 face-to-face 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, blended learning is useful for overcoming challenges and problems when studying algorithms and/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 blended studies 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 blended 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 mixed studies is trial and error [9].



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

The previous finding in blended study by the author with a learning mix of 40% face-to-face 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 blended learning is not only influenced by the study model but also influenced by student cognitive style, gender, and the mixed level of online and face-to-face studies. However, the questions are: How good is learning achievement in blended learning with a varied group of 60% face-to-face 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 blended learning with mixing of 60% face-to-face and 40% online in this study compared with the previous research with a mix rate of 40% face-to-face 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-blended lessons.

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

between the student of different genders? 2). in connection with comparing the results of this study (blended learning studies with a mixture of teaching materials 60% face-to-face and 40% online) with previous research results (blended learning lessons with a combination of teaching materials 40% face-to-face and 60% online): how does the comparison of cognitive styles and gender interact between the two Blended learning: blended learning of this study (with teaching material delivered 60% face-to-face and 40% online) compared prior research (with teaching material provided 40% face-to-face 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 a mixed learning environment by analyzing the relationship between student background and hybrid learning design on student learning achievement. This study used a survey method. It contributed to the fact that students' characteristics and design features determined mixed learning success [27]. This previous study does not consider the influence of students' cognitive styles, gender differences, and the combination of face-to-face material mixtures and online learning in mixed learning, as was done in this study.
- T. I. Oweis (2018) examines the effect of blended learning on student achievement and motivation to learn 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 face-to-face learning and mixed 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 face-to-face 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 mixed learning and examines the effect of interactions between cognitive style and gender with mixed learning methods
- N. R. Alsalhi, M. E. Eltahir, and S. S. Alqatawneh (2019) examined student achievement



1 differences in blended learning and face-to-face 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 mixed learning. This previous study's shortcomings do not explain the percentage of mixing in hybrid learning between face-to-face 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.

- Anthony 2 (2019) conducted experimental research on mixed learning with a mixture of 40% face-to-face learning material and 60% online learning material for Algorithm and Programming courses. In contrast, this article's research 2 conducted experimental research on mixed learning with a mixture of 60% face-to-face 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 5 predictor components that contribute to the success of face-to-face 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 mixed learning.

Referring to the elaboration of the latest related work by several researchers, in essence, this research article is a new study with mixed 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, blended learning received mixed subject matter treatment 1 with a learning ratio of 60% versus 40% between face-to-face classroom learning and online asynchronous independent learning. The success of this study's teaching was investigated

and compared with the success of the learning in previous blended learning research, which had a combination of learning mix between face-to-face and asynchronous online classes in contrast to mixed varieties in this study.

3.1 Population and Treatment

2 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 blended learning [24], while others said that an excellent blended learning mix is obtained through trial and error [6]. Therefore this study conducted a research experiment using a mixture of 60% face-to-face lessons and 40% online lessons. Students in this blended learning receive a face-to-face 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 blended 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 blended 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

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.

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 blended learning outcomes are greater or equal to 60% of the ideal value. The two-way ANOVA test conducted in this study was to ascertain whether there was an interplay between students' cognitive styles and gender on blended learning outcomes; are there differences in learning outcomes due to the influence of student cognitive styles; and are there differences in learning outcomes between students who are male and female gender. The comparative test using the independent 2-sample t-test to compare the results of blended 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 (blended learning with a mixture of 60% face-to-face and 40% online teaching materials), which are as follows:
 - H1: The study result of blended learning is greater 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 (blended learning with a mixture of 40% face-to-face and 60% online teaching materials), which is as follows:
 - H5: There is a difference in learning outcomes between the interplay of cognitive and gender styles of the two-blended lessons being compared, namely blended learning with teaching material delivered with a mix of 60% face-to-face and 40% online from previous research, and teaching materials delivered with a blend of 40% face-to-face and 60% online.

Actions taken to prevent threats to internal validity are as follows: Blended 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 face-to-face study control group as part of blended 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 blended 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 blended 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 blended 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

Score	Gender	Kolmogorov-smimov			Shapiro-wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Total	Male	.087	30	.200*	.972	30	.588
	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 blended 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 blended 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 blended learning model with a mixture of teaching subject matter of 60% face-to-face 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

	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the 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 blended 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 blended 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 blended learning results because 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 blended learning results of 60% face-to-face 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 blended learning with a mixed level of 60% face-to-face and 40% online, as shown in Table 12, revealed what is the distinction between study achievement in blended learning with mixing 60% face-to-face 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	
									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 Blended Learning with Mix Level of 60% Face-to-face and 40% Online

()InteractionVAK	()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 blended learning combining 60% face-to-face and 40% online found that men who prefer visual presentation are more successful than women who like a voice presentation. Scheffe test results of the previous study for blended learning with a mixed level of 60% face-to-face and 40% online are shown in table 13. Learning outcomes due to the interplay between cognitive style and gender of two blended lessons with a mixed rate of 60% face-to-face and 40% online are as shown in table 12, and blended learning with a varied level of 40% face-to-face, and 60% online is as shown in table 13. In the two-blended learning models taught with a mixture of 60% face-to-face and 40% online and a mixture of 40% face-to-face and 60% online, there is a 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 blended learning with a mix of 40% face-to-face and 60% online have superior learning results compared to those conducted with blended learning with a composite of 60% face-to-face and 40% online. Thus, the H5 research hypothesis is accepted.

Table 13. Multiple Comparison of Post-Hoc Scheefe of Learning Results of Blended Learning with Mix Level of 40% Face-to-face and 60% Online

(I)	(J)	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-5.92	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	3.083	.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	3.083	.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	-17.54*	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	-5.6
Vmale	Afemale	16.54*	2.340	.000	8.38	24.70
	AMale	10.62*	2.116	.001	3.24	18.00
	KMale	13.29*	3.083	.007	2.53	24.05
	VFemale	17.54*	2.839	.000	7.64	27.44
	Vmale	9.34	2.839	.076	-5.6	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 blended learning.

5. CONCLUSION

The conclusions of this research result are: (1) the blended learning with combination level of 60% face-to-face 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 blended learning with combination learning of 60% face-to-face and 40% online; (e), blended 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 face-to-face and online shows

that blended learning with greater online learning achieves better learning results especially for students that have visual learning styles.

The novelty of this research findings are:

- The cognitive style and gender of students interact and have different effects on blended learning achievement;
- 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.

For future research, it is necessary:

- To do the study on blended learning with other different mix levels so that we can find out the best and worst mixture in achieving composite learning outcomes for specific subjects;
- 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.

ACKNOWLEDGMENTS

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Similarity_Jatit_Interplay Between Cognitive Styles and Gender of 2 Blended Learning to Learning Achievements

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By Anthony Anggrawan

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

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ABSTRACT

Blended learning is a learning model that mixes face-to-face and online learning. Each learning model can determine individual students to succeed or fail. The mix combination in blended learning affects the pedagogical results. The questions are: how effective is the blended learning with a mixture of 60% face-to-face and 40% online; how the interplay results between cognitive styles and genders affect learning achievements; and what are the distinctions in learning achievement of blended learning study with a mixture of 60% face-to-face learning and 40% online compared to prior mixed learning study with a blend of 40% face-to-face and 60% online. This research objective compares the interplay results between the cognitive styles and the gender of the two-blended lessons. The research method is experimental. The research discloses that: blended learning with a mixture of 60% face-to-face and 40% online is a good learning 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. Blended learning with a combination of online teaching materials 20% greater than face-to-face teaching materials shows more successful learning outcomes. This study's favorable implication is that this study confirms that the mix of teaching materials and learning media is a primary component in determining achievement in blended learning.

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

1. INTRODUCTION

The three main models of learning are face-to-face, online, and blended learning. The blended learning model is a composite lesson of face-to-face and online, where the delivery of teaching material taught is partly face-to-face and partly online. In face-to-face 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 face-to-face learning model is superior to students' affective aspects which students can engage face-to-face 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 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 face-to-face class [6]. Moreover, based on previous research, online information sources' utilization increases student learning achievement [7]. However, some experts suggest learning solutions with blended learning, a learning concept used to integrate various activities [8].

Blended learning is an excellent solution because it adopts the prime advantages from face-to-face class and online study, including facilitating studies using information technology while preserving experience in a classroom environment [9][10]. As quoted by Simonson et al., the best of both worlds is blended learning [4] because, after blended learning supports students to study in a face-to-face 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, blended learning is a study solution by using Information and Communication Technology-based online study combined with traditional classroom activities [13]. Blended 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, the success of student study results is closely related to learning models and media and the cognitive styles that students have themselves. 25

The algorithms and Programming subject is one of the main skill subjects in the computer science 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 face-to-face 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, blended learning is useful for overcoming challenges and problems when studying algorithms and/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 blended studies 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 blended 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 mixed studies is trial and error [9].



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

The previous finding in blended study by the author with a learning mix of 40% face-to-face 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 blended learning is not only influenced by the study model but also influenced by student cognitive style, gender, and the mixed level of online and face-to-face studies. However, the questions are: How good is learning achievement in blended learning with a varied group of 60% face-to-face 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 blended learning with mixing of 60% face-to-face and 40% online in this study compared with the previous research with a mix rate of 40% face-to-face 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-blended lessons.

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

between the student of different genders? 2). in connection with comparing the results of this study (blended learning studies with a mixture of teaching materials 60% face-to-face and 40% online) with previous research results (blended learning lessons with a combination of teaching materials 40% face-to-face and 60% online): how does the comparison of cognitive styles and gender interact between the two Blended learning: blended learning of this study (with teaching material delivered 60% face-to-face and 40% online) compared prior research (with teaching material provided 40% face-to-face 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, Zhu, and E. Kagambe (2017) examined the effectiveness of a mixed learning environment by analyzing the relationship between student background and hybrid learning design on student learning achievement. This study used a survey method. It contributed to the fact that students' characteristics and design features determined mixed learning success [27]. This previous study does not consider the influence of student cognitive styles, gender differences, and the combination of face-to-face material mixtures and online learning in mixed learning, as was done in this study.
- T. I. Oweis (2018) examines the effect of blended learning on student achievement and motivation to learn 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 face-to-face learning and mixed 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 face-to-face 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 mixed learning and examines the effect of interactions between cognitive style and gender with mixed learning methods
- N. R. Alsalhi, M. E. Eltahir, and S. S. Alqatawneh (2019) examined student achievement



differences in blended learning and face-to-face 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 mixed learning. This previous study's shortcomings do not explain the percentage of mixing in hybrid learning between face-to-face 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.

- Anthony (2019) conducted experimental research on mixed learning with a mixture of 40% face-to-face learning material and 60% online learning material for Algorithm and Programming courses. In contrast, this article's research conducted experimental research on mixed learning with a mixture of 60% face-to-face 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 face-to-face 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, 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 mixed learning.

Referring to the elaboration of the latest related work by several researchers, in essence, this research article is a new study with mixed 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, blended learning received mixed subject matter treatment with a learning ratio of 60% versus 40% between face-to-face classroom learning and online asynchronous independent learning. The success of this study's teaching was investigated

and compared with the success of the learning in previous blended learning research, which had a combination of learning mix between face-to-face and asynchronous online classes in contrast to mixed 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 blended learning [24], while others said that an excellent blended learning mix is obtained through trial and error [6]. Therefore this study conducted a research experiment using a mixture of 60% face-to-face lessons and 40% online lessons. Students in this blended learning receive a face-to-face 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 blended 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 blended 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

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.

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 blended learning outcomes are greater or equal to 60% of the ideal value. The two-way ANOVA test conducted in this study was to ascertain whether there was an interplay between students' cognitive styles and gender on blended learning outcomes; are there differences in learning outcomes due to the influence of student cognitive styles; and are there differences in learning outcomes between students who are male and female gender. The comparative test using 22 independent 2-sample t-test is to compare the results of blended 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:

- There are four hypotheses for the results of this study (blended learning with a mixture of 60% face-to-face and 40% online teaching materials), which are as follows:
 - H1: The study result of blended learning is greater 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;
- There is 40 hypothesis to test the relationship between the results of this study compared to the effects of previous studies (blended learning with a mixture of 40% face-to-face and 60% online teaching materials), which is as follows:
 - H5: There is a difference in learning outcomes between the interplay of cognitive and gender styles of the two-blended lessons being compared, namely blended learning with teaching material delivered with a mix of 60% face-to-face and 40% online from previous research, and teaching materials delivered with a blend of 40% face-to-face and 60% online.

Actions taken to prevent threats to internal validity are as follows: Blended 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 face-to-face study control group as part of blended 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 blended 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 blended 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 blended 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

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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

Score	Gender	Kolmogorov-smimov			Shapiro-wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Total	Male	.087	30	.200*	.972	30	.588
	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 blended 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 blended 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 blended learning model with a mixture of teaching subject matter of 60% face-to-face 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

	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the 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 blended 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 blended 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 blended learning results because 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 ⁹ failed to reject, or there are distinctions in blended learning results of 60% face-to-face 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 blended learning with a mixed level of 60% face-to-face and 40% online, as shown in Table 12, revealed ³⁹ the distinction between study achievement in blended learning with mixing 60% face-to-face 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	
									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 Blended Learning with Mix Level of 60% Face-to-face and 40% Online

()InteractionVAK	()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 ¹ than women [25]. In comparison, this study about blended learning combining 60% face-to-face and 40% online found that men who prefer visual presentation are more successful than women who like a voice presentation. ¹ Scheffe test results of the previous study for blended learning with a mixed level of 60% face-to-face and 40% online are shown in table 13. Learning outcomes due to the interplay between ¹ cognitive style and gender of two blended lessons with a mixed rate of 60% face-to-¹ and 40% online are as shown in table 12, and blended learning with a varied level of 40% face-to-face, and 60% online is as shown in table 1². In the two-blended learning models taught with a mixture of 60% ¹ face-to-face and 40% online and a mixture of 40% face-to-face and 60% online, there is ² 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 blended learning with a mix of 40% face-to-face and 60% online have superior learning results compared to those conducted with blended learning with a composite of 60% face-to-face and 40% online. Thus, the H5 research hypothesis is accepted.

Table 13. Multiple Comparison of Post-Hoc Scheefe of Learning Results of Blended Learning with Mix Level of 40% Face-to-face and 60% Online

(I)	(J)	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-5.92	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	3.083	.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	3.083	.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	-17.54*	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	-5.6
Vmale	Afemale	16.54*	2.340	.000	8.38	24.70
	AMale	10.62*	2.116	.001	3.24	18.00
	KMale	13.29*	3.083	.007	2.53	24.05
	VFemale	17.54*	2.839	.000	7.64	27.44
	Vmale	9.34	2.839	.076	-5.6	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 blended learning.

5. CONCLUSION

The conclusions of this research result are: (a), the blended learning with combination level of 60% face-to-face 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 blended learning with combination learning of 60% face-to-face and 40% online; (e), blended 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 face-to-face and online shows

that blended 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 blended 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.

For future research, it is necessary:

- (a) To do the study on blended learning with other different mix levels so that we 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.

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Similarity_Interplay between Cognitive Styles and Gender of Two Hybrid Learning to Learning Achievements

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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 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 study 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 learning 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 study's favorable implication is that this study confirms that the mix of teaching materials and learning media is a primary component in determining achievement in hybrid learning.

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 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.

Algorithms and Programming is the primary skill lessons 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)?.

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 work [10].

- 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. [38]
- 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 [4].
- N. R. Alsalhi, 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.

- Anthony (2019) [28] conducted experimental research on hybrid learning with a blend of 40% F2F learning material and 60% online learning material for Algorithm and Programming courses. 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 [26] previous research is that it only predicts that students' cognitive style and gender have an effect on learning achievement. Meanwhile, the [26] 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 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.

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. 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

Score	Gender	Kolmogorov-smimov			Shapiro-wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Total	Male	.087	30	.200*	.972	30	.588
	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

	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the 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 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
Gender*VAK	176.183	1	176.183	7.325	.010
VAKB2	170.585	2	85.293	3.546	.037
Gender*VAK*B2	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
ScoreB2*VAK	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 students 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	95% Confidence Interval of the Difference		
								Lower	Upper	
ScoreB2*VAK	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

Interaction*VAK	Interaction*VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	Abmale	-3.06	1.913	.242	-11.73	1.60
	Kfemale	-11.23*	3.061	.033	-21.89	-5.7
	Kbmale	-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	3.06	1.913	.242	-1.60	11.73
	Kfemale	-6.17	3.061	.556	-16.91	4.58
	Kbmale	-4.5	2.273	1.000	-8.37	7.46
	Vfemale	6.17	3.061	.556	-4.58	16.91
	Vmale	-4.50	1.913	.393	-11.30	2.30
Kfemale	Afemale	11.23*	3.061	.033	3.7	21.89
	Abmale	6.17	3.061	.556	-4.58	16.91
	Kbmale	5.71	3.296	.700	-5.77	17.20
	Vfemale	12.33	3.902	.094	-1.26	25.93
	Vmale	1.67	3.061	.998	-9.60	12.41
Kmale	Afemale	3.32	2.240	.319	-2.29	13.32
	Abmale	4.5	2.273	1.000	-7.46	8.47
	Kfemale	-5.71	3.296	.700	-17.20	5.77
	Vfemale	6.62	3.296	.552	-4.87	18.11
	Vmale	-4.05	2.273	.675	-11.96	3.87
Vfemale	Afemale	-3.10	3.061	1.000	-11.76	9.56
	Abmale	6.17	3.061	.556	-16.91	4.58
	Kbmale	-12.33	3.902	.094	-25.93	1.26
	Vmale	-6.62	3.296	.552	-18.11	4.87
	Vmale	-10.67	3.061	.053	-21.41	-9.96
Vmale	Afemale	9.56*	1.913	.001	2.90	16.23
	Abmale	4.50	1.913	.393	-2.30	11.30
	Kbmale	-3.67	3.061	.998	-12.41	9.60
	Vfemale	4.05	2.273	.675	-3.87	11.96
	Vmale	10.67	3.061	.053	-9.60	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.

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

(i) Interaction VAK	(j) Interaction VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
AFemale	AMale	-5.93	2.340	.000	-14.08	2.24
	KFemale	-3.25	3.242	.960	-14.36	8.06
	OFemale	1.00	3.009	1.000	-9.49	11.49
	VFemale	-7.20	3.009	.000	-17.69	3.29
AMale	AFemale	5.93	2.340	.000	-2.24	14.08
	KFemale	2.67	3.085	.979	-8.08	13.43
	OFemale	6.92	2.839	.000	-2.96	16.82
	VFemale	-1.28	2.839	.999	-11.18	8.62
KFemale	AMale	-10.62	2.116	.000	-18.00	-3.24
	AFemale	3.25	3.242	.960	-3.06	14.56
	AMale	-2.67	3.085	.979	-13.43	8.08
	OFemale	4.25	3.619	.924	-8.37	16.87
VFemale	AFemale	-3.95	3.619	.843	-16.57	8.67
	AMale	-13.29	3.085	.000	-24.05	-2.53
	AMale	-1.00	3.009	1.000	-11.49	9.49
	AFemale	-6.92	2.839	.000	-16.82	2.98
AMale	KFemale	-4.25	3.619	.924	-16.87	8.37
	VFemale	-8.20	3.412	.000	-20.10	3.70
	VFemale	-17.54	2.839	.000	-27.44	-7.64
	VFemale	7.20	3.009	.000	-3.29	17.69
AFemale	AMale	1.28	2.839	.999	-8.62	11.18
	KFemale	3.95	3.619	.843	-8.67	16.57
	VFemale	8.20	3.412	.000	-3.70	20.10
	VFemale	-9.34	2.839	.000	-19.24	-.66
VFemale	AMale	16.24	2.340	.000	13.88	24.70
	AMale	10.62	2.116	.000	3.24	18.00
	KFemale	13.29	3.085	.000	2.53	24.05
	VFemale	17.34	2.839	.000	7.64	27.44
VFemale	AMale	9.34	2.839	.000	-5.6	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.

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:

- The cognitive style and gender of students interact and have different effects on hybrid learning achievement;
- 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.

For future research, it is necessary:

- To do the study on hybrid learning with other different mix levels so that we can find out the best and worst mixture in achieving composite learning outcomes for specific subjects;
- 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.

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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 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.

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 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.

Algorithms and Programming is the primary skill lessons 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)?.

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. Alsalhi, 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.

- A. Anggrawan et al. (2019), their research 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 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.

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. 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	Sig.	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				
	T	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the 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 students 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 Lower	Upper
ScoreB2VAK	.002	.946	3.484	48	.001	5.517	1.583	-2.333	4.700

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

InteractionVAK	InteractionVAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-5.96	1.913	.242	-11.73	1.60
	KFemale	-11.23*	3.061	.033	-21.89	-5.57
	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	5.96	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	3.52	2.240	.319	-2.39	13.32
	AMale	-4.5	2.273	1.000	-7.46	8.17
	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	-0.8	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.

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

(I) Interaction VAK	(J) Interaction VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
AFemale	AMale	-5.92	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	-3.06	14.26
	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
	KFemale	-4.25	3.619	.924	-16.87	8.37
	VFemale	-8.20	3.412	.347	-20.10	3.70
	VMale	-17.54*	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
	KFemale	3.95	3.619	.943	-8.67	16.57
	KMale	8.20	3.412	.347	-3.70	20.10
	VMale	-9.34	2.839	.076	-19.24	-.56
VMale	AFemale	16.54*	2.340	.000	8.38	24.70
	AMale	10.62*	2.116	.001	3.24	18.00
	KFemale	13.29*	3.085	.007	2.53	24.05
	KMale	17.54*	2.839	.000	7.64	27.44
	VFemale	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.

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.

For future research, it is necessary:

- (a) To do the study on hybrid learning with other different mix levels so that we 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.

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Similarity_Interplay Between Cognitive Styles and Gender of Two Hybrid Learning to Learning Achievements

By Anthony Anggrawan

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 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.

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 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.

Algorithms and Programming is the primary skill lessons 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)?.

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. 36
- 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
- 4 R. Alsalhi, 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.

- A. Anggrawan et al. (2019), their research 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 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.

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. 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	



2 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	Sig.	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				
	T	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the 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, 6 is also known that gender differences affect the results of the hybrid study because the significance value of the Anov 32 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
Gender*VAK	176.183	1	176.183	7.325	.010
VAKB2	170.585	2	85.293	3.546	.037
Gender*VAK*B2	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
ScoreB2*VAK	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 students 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	95% Confidence Interval of the Difference		
								Lower	Upper	
ScoreB2*VAK	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

Interaction*VAK	Interaction*VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	Abmale	-3.06	1.913	.242	-11.73	1.60
	Kfemale	-11.23*	3.061	.033	-21.89	-5.7
	Kbmale	-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	3.06	1.913	.242	-1.60	11.73
	Kfemale	-6.17	3.061	.556	-16.91	4.58
	Kbmale	-4.5	2.273	1.000	-8.37	7.46
	Vfemale	6.17	3.061	.556	-4.58	16.91
	Vmale	-4.50	1.913	.393	-11.30	2.30
Kfemale	Afemale	11.23*	3.061	.033	3.7	21.89
	Abmale	6.17	3.061	.556	-4.58	16.91
	Kbmale	5.71	3.296	.700	-5.77	17.20
	Vfemale	12.33	3.902	.094	-1.26	25.93
	Vmale	1.67	3.061	.998	-9.60	12.41
Kmale	Afemale	3.32	2.240	.319	-2.29	13.32
	Abmale	4.5	2.273	1.000	-7.46	8.47
	Kfemale	-5.71	3.296	.700	-17.20	5.77
	Vfemale	6.62	3.296	.552	-4.87	18.11
	Vmale	-4.05	2.273	.675	-11.96	3.87
Vfemale	Afemale	-3.10	3.061	1.000	-11.76	9.56
	Abmale	6.17	3.061	.556	-16.91	4.58
	Kbmale	-12.33	3.902	.094	-25.93	1.26
	Vmale	-6.62	3.296	.552	-18.11	4.87
	Vmale	-10.67	3.061	.053	-21.41	0.08
Vmale	Afemale	9.56*	1.913	.001	2.90	16.23
	Abmale	4.50	1.913	.393	-2.30	11.30
	Kbmale	-3.67	3.061	.998	-12.41	9.68
	Vfemale	4.05	2.273	.675	-3.87	11.96
	Vmale	10.67	3.061	.053	0.08	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.

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

(i) Interaction VAK	(j) Interaction VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
AFemale	AMale	-5.93	2.340	.089	-14.08	2.24
	KFemale	-3.25	3.242	.960	-14.36	8.06
	KMale	1.00	3.009	1.000	-9.49	11.49
	VFemale	-7.20	3.009	.352	-17.69	3.29
AMale	AFemale	-16.54*	2.340	.000	-24.70	-8.38
	KFemale	2.25	2.520	.289	-2.25	14.08
	KMale	2.67	3.085	.979	-8.08	13.43
	VFemale	6.92	2.839	.330	-2.99	16.82
KFemale	AFemale	-1.28	2.839	.999	-11.18	8.62
	AMale	-10.62*	2.116	.000	-18.00	-3.24
	KMale	3.25	3.242	.960	-3.06	14.56
	VFemale	-2.67	3.085	.979	-13.43	8.08
KMale	AFemale	4.25	3.619	.924	-8.37	16.87
	AMale	-3.95	3.619	.843	-16.57	8.67
	VFemale	-13.29*	3.085	.007	-24.05	-2.53
	VMale	-1.00	3.009	1.000	-11.49	9.49
VFemale	AFemale	-6.92	2.839	.330	-16.82	2.98
	AMale	-4.25	3.619	.924	-16.87	8.37
	KFemale	-8.20	3.412	.347	-20.10	3.70
	KMale	-17.54*	2.839	.000	-27.44	-7.64
VMale	AFemale	7.20	3.009	.352	-3.29	17.69
	AMale	1.28	2.839	.999	-8.62	11.18
	KFemale	3.95	3.619	.843	-8.67	16.57
	KMale	8.20	3.412	.347	-3.70	20.10
VFemale	AFemale	-9.34	2.839	.076	-19.24	-5.6
	AMale	16.54*	2.340	.000	13.88	24.70
	KFemale	10.62*	2.116	.000	3.24	18.00
	KMale	13.29*	3.085	.007	2.53	24.05
VMale	AFemale	17.34*	2.839	.000	7.64	27.44
	AMale	9.34	2.839	.076	-5.6	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.

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:

- The cognitive style and gender of students interact and have different effects on hybrid learning achievement;
- 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.

For future research, it is necessary:

- To do the study on hybrid learning with other different mix levels so that we can find out the best and worst mixture in achieving composite learning outcomes for specific subjects;
- 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.

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Similarity Test_Interplay between Cognitive Styles and Gender of Two Hybrid Learning to Learning Achievements

By Anthony Anggrawan

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.



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- N. R. Alsalhi, M. E. Eltahir, and S. S. Al-qatawneh (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) [18] 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 [13] 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 [27] previous research is that it only predicts that students' cognitive style and gender have an effect on learning achievement. Meanwhile, the [27] dy 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

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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 [36] 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 [33] 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

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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-smimov			Shapiro-wilk		
		Statistic	Df	Sig.	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

	T	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the 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, [32] 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	
									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

()InteractionVAK	()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.

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

(i) Interaction VAK	(j) Interaction VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-5.92	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	3.083	.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	3.083	.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	-17.54	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	-5.6
Vmale	Afemale	16.54	2.340	.000	8.38	24.70
	AMale	10.62*	2.116	.001	3.24	18.00
	KMale	13.29*	3.083	.007	2.53	24.05
	VFemale	17.54*	2.839	.000	7.64	27.44
	Vmale	9.34	2.839	.076	-5.6	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 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:

- The cognitive style and gender of students interact and have different effects on hybrid learning achievement;
- 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.

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 [18] in 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:

- 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;
- 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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Similarity Test _ Interplay between Cognitive Styles and Gender of Two Hybrid Learning to Learning Achievements

By Anthony Anggrawan

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.



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- N. R. Alsalthi, M. E. Eltahir, and S. S. Al-qatawneh (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) [13] 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 [10] 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 [19] previous research is that it only predicts that students' cognitive style and gender have an effect on learning achievement. Meanwhile, the [19] 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

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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 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:

- 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;
- There is 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	

2 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-smimov			Shapiro-wilk		
		Statistic	Df	Sig.	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

	T	df	Sig.(2-tailed)	95% Confidence Interval of the Difference		
				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, [27] 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	
									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

()InteractionVAK	()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.

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

(i) Interaction VAK	(j) Interaction VAK	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Afemale	AMale	-5.92	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	3.083	.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	3.083	.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	-17.54*	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	-5.6
Vmale	Afemale	16.54*	2.340	.000	8.38	24.70
	AMale	10.62*	2.116	.001	3.24	18.00
	KMale	13.29*	3.083	.007	2.53	24.05
	VFemale	17.54*	2.839	.000	7.64	27.44
	Vmale	9.34	2.839	.076	-5.6	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.

4 is 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:

- The cognitive style and gender of students interact and have different effects on hybrid learning achievement;
- 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.

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 [13] in 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:

- 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;
- 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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Thank you very much for your prompt response.
God bless you.

Best regards

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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. Alsalhi, 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	
											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	-.45	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	-.45	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.

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 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.

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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Title:	FACTORS AFFECTING THE INTENTION TO USE MOBILE APPLICATION ONLINE TRAVEL AGENCY
Author:	WIZA TEGUH, VIANY UTAMI TJHIN
Abstract:	E-commerce has become a new shopping trend in the last few years. A type of e-commerce selling and buying objects in travel services is known as an online travel agency (OTA). OTA's presence is intended to make it easier for customers and travel suppliers to do transactions regarding travel services. It is widely predicted that the OTA ecosystem will continue to grow, seeing the increasingly massive internet use trend and the increasing use of smartphones. Even so, this does not mean that OTA companies are not experiencing challenges. It is proven that some companies cannot survive and eventually out of business. It happened because the company is unable to meet the needs and desires of its buyers. This research aims to analyze the factors that influence the intention to use the OTA mobile application using PLS-SEM. The research model was built based on a combination of TAM, UTAUT, ISS model, and perceived risk. The research results on 261 samples showed that the intention of using the OTA mobile application was influenced positively and significantly by perceived usefulness and hedonic motivation. This study's other constructs include social influence, information quality, system quality, service quality, perceived risk, and habit. However, they do not significantly positively affect the intention to use the OTA mobile application.
Keywords:	Intention to Use, Online Travel Agency, Mobile Application, SEM-PLS, Online Tourism
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Title:	ABNORMAL EVENT DETECTION IN INDOOR ENVIRONMENT BASED ON ACOUSTIC SIGNAL PROCESSING
Author:	RUSTAM ABDRAKHMANOV, ABDIMUKHAN TOLEP, ZHAZIRA KOZHAMKULOVA, NURLAN NARBEKOV, NURBAI DOSSANOV, BAKYTGUL YESKARAYEVA
Abstract:	Alert the public about emergencies is to bring to public alerts and emergency information on dangers arising from the threat or occurrence of emergency situations of natural and technogenic character, as well as the conduct of hostilities or owing to these actions, the rules of behavior of the population and the need for protection activities. The aim of the work is to develop a method for detecting the sounds of critical situations in the sound stream. In this paper, the term "critical situation" is understood as an event, the characteristic sound signs of which can speak of acoustic artifacts (a shot, a scream, a glass strike, an explosion, a siren, etc.). The developed method allows you to classify events into two groups: normal (for example, street noise) and critical situations (for example, an explosion, a scream, a shot). To determine events, machine learning is used, namely the Support Vector Machine method, which solves classification and regression problems by constructing a nonlinear plane separating the solutions. SVM has a fairly wide application in data classification and shows good results in event detection problems. As part of the work, the minimum set of features for the machine learning model was determined, small training and test samples were formed, and a method was developed that classifies normal and abnormal events.
Keywords:	Audio Event, Impulsive Sounds, Signal Processing, Machine Learning, Acoustic Signals, Signal Processing
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	ENHANCED THE DFIG SYSTEM BEHAVIOR UNDER SYMMETRICAL SAG VOLTAGE
Author:	TARIQ RIOUCH, RACHID EL-BACHTIRI
Abstract:	This paper proposes a novel scheme to improve the low voltage ride-through (LVRT) capability of the doubly-fed induction generator (DFIG) based wind power (WT). The main problems of DFIG are; its sensitivity to voltage sag in side and the sudden variation in wind speed on the other side, these problems causes the fluctuations in the output power, overcurrent in rotor winding and overshoot in the dc bus voltage. A Hybrid Energy Storage System (HESS) connected in parallel with the rotor side converter of the DFIG, and an adequate control of the HESS are suggested to enhance the DFIG behavior. The simulations

	is conducting in MATLAB/Simpower system environment, The results show that the proposed scheme can not only enhanced the DFIG behavior under fault, but also smooth the power injected in grid under normal operation with the sudden variation of the wind speed.
Keywords:	Wind power generation; doubly fed induction generator (DFIG); Hybrid Energy Storage System (HESS); Voltage sag; Power fluctuation
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	A NOVEL SYMMETRIC HYBRID CRYPTOGRAPHY TECHNIQUE USING LINEAR BLOCK CIPHER (LBC) AND SIMPLE SYMMETRIC KEY
Author:	PRAKASH KUPPUSWAMY, SAEED Q AL-KHALIDI AL-MALIKI
Abstract:	Data encryption technique is the art of cryptology protecting valuable information or data by transforming it into an unreadable scrambled text. Cryptography algorithm is a mathematical technique used to preventing or safeguard messages from unsolicited access. In the current digital environment, public, private financial institutions data transactions conducts through open network channel only. Therefore, it is significant to implement cryptography techniques on those financial data to secure valuable things. In many sectors exploiting private algorithms such as DES, AES and public algorithms such as RSA, Diffie-hellman been using in various applications. Public key or Asymmetric key encryption technique has connection with many performance issues such as energy consumption, memory wastage and computational problems etc., Correspondingly, symmetric key algorithm also has a problem of non-repudiation, false modification etc., to overcome the above issues and enhance the confidentiality to make it stronger, hybrid cryptography techniques offered better solution. In short, the hybrid technique uses the combination of two or more encryption algorithms. The proposed hybrid algorithm is combination of enhanced hill cipher algorithm using modulo 37 and using simple positive and negative integer numbers. Many hybrid algorithm follows different logic to provide more security, we proposed here, simple and open design, straightforwardness, computational speed, more privacy. and security compared to existing hybrid encryption schemes.
Keywords:	Symmetric Key, Asymmetric Key, Hybrid Encryption, Block cipher, RSA, DES, AES etc.,
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Title:	EVALUATION OF THE SUCCESS OF THE REKON.ID MOBILE ATTENDANCE APPLICATION USING THE DELONE AND MCLEAN APPROACH
Author:	RAHMAT IVAN AZIZ, EMIL ROBERT KABURUAN
Abstract:	This study discusses the evaluation process on the use of the Rekon.id application at the company PT Solusi Konvergen. The Rekon.id application is an application made by companies to record every activity carried out by employees and help employees to carry out administrative processes every day. However, at the time of its application, the Rekon.id application experienced a decrease in users every month. So, with these problems, companies must evaluate the use of the application. This study conducted an evaluation process for the success of the Rekon.id application using the DeLone and McLean model which consisted of system quality, information quality, service quality, usage, user satisfaction, and net benefits. This study uses 235 samples of Rekon.id application users to test and perform quantitative analysis in the evaluation process of using the Rekon.id application. The results of the 10 hypothesis test conducted show that the variables that have a positive relationship are information quality on user satisfaction, system quality on user satisfaction, service quality on use, and user satisfaction with net benefits.
Keywords:	Evaluation Information System, Information System, Mobile Attendance, DeLone and McLean Approach.
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Title:	EduDIS CONSTRUCTION TECHNOLOGY BASED ON Z39.50 PROTOCOL
Author:	S.K.SERIKBAYEVA, D.A.TUSSUPOV, M.A.SAMBETBAYEVA, A.S. YERIMBETOVA, TASZHUREKOVA ZH.K., BORANKULOVA G.S.
Abstract:	The most effective way to solve the problems of organizing access to distributed information resources is to organize information about them in information systems that are open in the form of electronic libraries. We formulated the basic principles of EduDIS implementation based on the use of the ideas of the electronic library. The article is about the implementation of an information system that provides unified access to distributed resources. The paper considers general issues of organizing access to distributed information resources, as well as the main components of such a system. The main aspects of joint use of Z39.50 protocols for access to distributed information resources are disclosed. In our paper, we provided a functional overview of the protocol itself and the history of standards, described some of the European initiatives that use it, and addressed various questions related to its future use and adoption. Z39.50 is an important building

	block of future distributed information systems. Moreover, in this paper, we discuss the description of the search for terms in the thesaurus and the algorithm for constructing a tree of terms based on abstract access to the thesaurus, organized in accordance with the Zthes profile of the Z39.50 protocol.
Keywords:	Distributed information systems, EduDIS, Z39.50, thesaurus, Zthes, RPN.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	STEGO IMAGE CORRUPTION DETECTION AND SECRET TEXT RECOVERY IN STEGANOGRAPHY COMMUNICATION
Author:	JAGAN RAJ J, C. KAVITHA, K. SAKTHIVEL
Abstract:	In this proposed work, an effort has been made to use multiple image files for steganography encoding alongside with the potential of secret text recovery in the event of any image corruption during the stego image transit. Proposed algorithm is effective on the safety factors of secret image, since the embedded checksum will validate for any unauthorized users or intruders, who plan to corrupt the image in any aspect. If any of the stego image underwent any steganalysis or Man in the Middle attack, then this proposed algorithm can effectively identify the potential corruption. The proposed multi cover image steganography model enables the receiver to send the secret text in more secured way and has the ability to detect the corruption in secret message. This solution is not only detecting the possible cover image corruptions but it also withstands one stego image corruption and has the capability to recover the original secret text even after one stego image corruption during the transmission of the secret message. This proposed work will increase the security of secret text that are being sent using steganography methods.
Keywords:	Image Steganography, Multi-Image Steganography, Data Corruption Detection
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Title:	MACHINE LEARNING METHODS FOR IMPROVING THE QUALITY OF IMAGES FROM CCTV CAMERAS ON RAILWAY TRANSPORT
Author:	ISSAIKIN D., ZHAMANGARIN D., AKHMETOV B., LAKHNO V., OMAROVA B., OMAROVA G., MAILYBAEV E.
Abstract:	The article has developed a methodology for changing the resolution (RS) of images obtained from CCTV cameras on railway transport. The research was carried out on the basis of the application of machine learning methods (MLM). Due to the implementation of this approach, it was possible to expand the functionality of the MLM. In particular, it was proposed to carry out the resampling process with the target frame information factor of the image. This coefficient is applicable for both increasing and decreasing of RS. This should provide a high quality of resampling and, at the same time, reduce the training time for neural-like structures (NLS). There was developed a method of changing the RS using the NLS. This contributes to the high efficiency of resampling of the images obtained from CCTV cameras, according to the criterion based on PSNR. The proposed solutions are characterized by a reduction in the size of the computing resources that are required for such a procedure. The proposed solutions are characterized by a reduction in the size of the computing resources that are required for such a procedure.
Keywords:	Video Surveillance Systems, Railway Transport, Image Quality Improvement, Neural Networks
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	A DESIGN OF A NEW HASH FUNCTION BASED ON CELLULAR AUTOMATA
Author:	YOUSSEF SBAYTRI, SAIIDA LAZAAR
Abstract:	Cryptographic hash functions play an important role in information security. They are used in several cryptographic applications to verify the integrity and authenticity of data. The hash functions are also the basis of blockchain technology. Many hash function constructions are inspired by boolean functions. The proposed hash function algorithm in this paper is based on Elementary Cellular Automata (ECA) and 2- dimensional Cellular Automata (2DCA), which are another type of boolean functions that have excellent cryptographic properties. This algorithm has a sponge construction as such as SHA-3. The strict avalanche criterion (SAC) and NIST statistical tests suite (STS) were used to measure the security of this algorithm. The obtained results demonstrate that the proposed algorithm exhibit high sensitivity to input changes.
Keywords:	Cryptographic hash function, Blockchain, Sponge construction, Cellular Automata, Elementary Cellular Automata, Boolean function, NIST statistical tests suite, Avalanche Effect.

Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021
	Full Text
Title:	TRIP PLANNING ALGORITHM FOR GTFS DATA WITH NOSQL STRUCTURE TO IMPROVE THE PERFORMANCE
Author:	MUSTAFA ALZAIDI, ANIKO VAGNER
Abstract:	Nowadays, GTFS (General Transit Feed Specification) data is used by many transport agencies as a standard format for publishing their data. Trip planning applications where a user can plan a trip between two locations are widely used. This paper will introduce an algorithm to found all possible trip plans between any two locations using GTFS data. The algorithm uses both stop and route level search to found the possible transition to be made. We introduce a technique that reduces the server overhead by defining and implementing a Redis NoSQL data structure to store all possible search results. Trip planning request at the server will be served by querying the Redis structure instead of run the algorithm with each request. We experiment, measure, and list the server performance using this technique with two different GTFS data sets and compare performance with and without using it.
Keywords:	GTFS, Trip Planning, Redis, NoSQL, Smart City.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021
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Title:	OPTICAL AMPLIFIERS FOR REACH EXTENSION OF PASSIVE OPTICAL NETWORK FOR RURAL SETTLEMENTS
Author:	A.TUSSUPOV, N.I.LISTOPAD, A.T.TOKHMETOV
Abstract:	This article is devoted to reach extended PON and optical amplifier technologies to extend physical limitation of PON from 20km to 60 km. with analysis of optical amplifiers, like EDFA, Raman, SOA amplifier, quantum-well and quantum-dot semiconductor optical amplifier for reach extension and the corresponding requirements of PON.
Keywords:	FTTH, PON, OA, PON, SOA, EDFA, QD-SOA.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021
	Full Text

Title:	DEEP LEARNING-BASED CANCER CLASSIFICATION FOR MICROARRAY DATA: A SYSTEMATIC REVIEW
Author:	NASHAT ALREFAI, OTHMAN IBRAHIM
Abstract:	Deep neural networks are robust techniques and recently used extensively for building cancer classification models from different types of data. Nowadays, microarray gene expression datasets consider an essential source of data that is used in cancer classifications. However, due to the small size of samples compared to the high dimensionality of microarray data, many machine learning techniques have failed to distinguish the most relevant and informatics genes. Therefore, deep learning is demand due to its ability to automatically discovering the complex relationship between features with significant accuracy and high performance. The current study aims to reveal the state-of-the-art of deep neural network architectures and how it can utilize from microarray data. Therefore, several deep neural network architectures were built such as CNN, DNN, RNN, DBN, DBM and DAE to be compatible with the different learning processes (supervised, unsupervised and semi-supervised). As a result, CNN considers the most common neural network architecture used in the medical field due to its robustness and high performance in cancer classification. Results indicate that choosing suitable architecture of the deep neural network and its hyper-parameters is one of the most difficulties facing the researcher in designing models for cancer prediction and classification because there is no particular rule to ensure high prediction accuracy.
Keywords:	Deep Learning; Cancer Classification; Convolutional Neural Network; Transfer Learning; Microarray.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021
	Full Text

Title:	RESEARCH AND MODELING OF THE PROCESS OF SULFUR PRODUCTION IN THE CLAUS REACTOR USING THE METHOD OF ARTIFICIAL NEURAL NETWORKS
Author:	ZH.YE. SHANGITOVA , B.B. ORAZBAYEV , L.T. KURMANGAZIYEVA , T.T. OSPANOVA , R.U. TULEUOVA5
Abstract:	The Claus sulfur recovery process is the most important in natural gas desulfurization technology. Taking into account the large-tonnage facilities, it is urgent to solve the problem of effective management, which will allow obtaining a significant economic effect. When

	studying catalytic reactions and processes, mathematical modeling methods are most often used, which allow describing changes in the states of the system under study. An alternative approach to modeling chemical-technological processes can be the use of artificial neural networks, which make it possible to take into account the features of the processes under study as much as possible. The article is devoted to the study of the chemical-technological process of sulfur production in the Claus reactor by the method of artificial neural networks (ANN). This article describes the relevance of neural networks using in chemical-technological systems. Similar works on the research topic are presented. The analysis of the sulfur production unit as an object of management has been carried out. The main parameters influencing the process of sulfur production have been identified and investigated. The results of the study of sulfur production process using fuzzy logic are presented. Backpropagation algorithm is described. Based on the input data of a mathematical model with a multiple regression structure and real data from the Claus reactor, the Backpropagation Algorithm of multilayer neural networks in Python has been implemented. Based on the results of the program, the output values and errors dependences graphs have been built. As a result of the study, sufficient convergence of the results of modeling using mathematical models is shown on ANN and real production data.
Keywords:	Backpropagation Algorithm, Multi-layer Neural Networks, Python, Sulfur, Artificial Neural Networks
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	DEVELOPMENT OF BUSINESS PROCESS DESIGN METHODS
Author:	BOLSHIBAYEVA A.K. , USKENBAYEVA R.K. , KUANDYKOV A.A., RAKHMETULAYEVA S.B. , ASTAUBAYEVA G.N.
Abstract:	In all economic and production-technological areas (or processes), business processes are the main objects that unite everything that is related to the achievement of the goal. There are many models of business processes that do not sufficiently reflect the features of the business process and the needs of a person in the business process. In other words, all kinds of model are functionally incomplete. Business process analysis is becoming extremely important for manufacturing and logistics systems as it plays a vital role in the successful improvement of business processes. The goal of process analysis is to unlock new knowledge to solve problems and optimize processes to create core competencies. A large amount of research and development has been carried out to optimize the performance of business processes in this complex and dynamic environment. Several methodologies, techniques and tools have been developed to analyze and optimize business processes in the field of production and logistics. Therefore, more and more new approaches to the description of business processes appear. In this work , we offered universally th business process model, which is called the base. Since, all other views of business processes are derived from the basic business process representation by the model.
Keywords:	Business Process, Design Methods, Modeling, Knowledge Analysis
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	CTGAN VS TGAN? WHICH ONE IS MORE SUITABLE FOR GENERATING SYNTHETIC EEG DATA
Author:	MIN JONG CHEON, DONG HEE LEE, JI WOONG PARK, HYE JIN CHOI, JUN SEUCK LEE, OOK LEE
Abstract:	BCI has been an alternative method of communication between a user and a system, and EEG is a representative non-invasive neuroimaging technique in BCI research. However, gathering a large dataset of EEG is difficult due to insufficient conditions. Therefore, a data augmentation is required for the data and a generative adversarial network is a representative model for the augmentation. As the EEG data is a CSV format, we decided to utilize CTGAN and TGAN for creating synthetic data. Our research was conducted through 3 steps. First of all, we compared two datasets from each model through data visualization. Secondly, we conducted a statical method for calculating similarity score. Lastly, we used both data as input data of the machine learning algorithms. Through the first step and second step, we found that the data from CTGAN has higher similarity than TGAN. However, in the last step, the result showed that the result such as accuracy, precision, recall, f1 score showed no significant difference between the two datasets. Furthermore, compared to the original dataset, none of the synthetic datasets showed higher scores. Therefore, we concluded that further research is needed to find out a better method for data augmentation so that the synthetic data could be utilized for the input data of machine learning or deep learning algorithms.
Keywords:	Deep Learning, GAN, EEG, BCI, Data Augmentation, Artificial Intelligence
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Title:	VOLTAGE STABILITY ANALYSIS USING CONTINUATION POWER FLOW UNDER CONTINGENCY
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Author:	MADHAVI GUDAVALLI, HARIKA VEMULAPALLI, KUMAR CHERUKUPALLI
Abstract:	This paper presents the knowledge of a continuation power flow (CPF) analysis to be used in a voltage stability analysis (VSA) to regulate the power in huge systems. Prominent feature of the continuation power flow is that it remains well-conditioned at and around the critical point. As significance, divergence due to ill conditioning is not encountered at the critical point, even when solitary meticulousness computation is used. It begins with a few basic values of the process and leads to a critical stage. The quiescent attribute of this approach is that it ruins fit at the anticipated stage, even though a particular estimation is used. In this paper system voltage, active power losses, reactive power losses and voltage stability are analyzed using a continuation power flow algorithm with and without contingency under load changing condition.
Keywords:	Continuation Power Flow, Contingency, Corrector, Critical Point, Predictor, Stability Index, L-Index, Jacobian, Tangent Vector
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	FLOOD CONGESTION SIMULATION AND PREDICTION USING IOT WIRELESS NETWORKS ON DYNAMIC STREETS ROUTES
Author:	MONNEEF M JAZZAR
Abstract:	Floods are among the natural hazards that are the most common as well as devastating. The worrying numerous flood-related fatalities and economic losses incurred yearly globally call for enhanced flood prediction. Remarkably, the previous decade has presented great chances with a series of studious events investigating how wireless data from the internet of things (IoT) networks can enhance flood prediction. This paper backs by emphasizing the key approaches of flood congestion prediction and IoT sensor-based techniques for real-time flood observatory, flood prototyping, mapping, and prompt flood prediction systems comprising the water level estimation. With the exponential increment of data available and computational capability, simulation techniques for uncertainty approximation of flood prediction is presented. We present the development of IoT Flood Simulator system that process individual nodes as well as multiple nodes datasets of multiple-sources of roads conjunctions collected via IoT wireless sensor networks. The system also locates the predicted flood and shows warnings on real map of the study area.
Keywords:	Wireless sensor networks, Floods prediction, Dynamic streets routes, IoT Technology, Simulation.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	A NEW HYBRID MULTI-FOCUS IMAGE-FUSION USING DMWT WITH FFT TRANSFORMS
Author:	ADNAN HADI MAHDI AL-HELALI , JAMAL S. ZRAQOU , WISSAM.ALKHADOUR , ABDULLA AL-NUEMI
Abstract:	A new technique of image fusion combining multi-focus images is proposed. It employs Discrete Multi-Wavelet Transform (DMWT) together with Fast Fourier Transform (FFT). Two source images are decomposed by FFT and DMWT first, then, treated by three different fusion rules, namely maximum selection rule, gradient rule, and absolute maximum selection rule for merging coefficients low and high-frequency sub-bands. This technique is experimentally implemented and tested on the often-used grayscale images, then the obtained results are compared with other multi-focus techniques, such as the Simple Pixels Averaging (SPA), the Principal Component Analysis (PCA), and wavelet transform (WLT). It was found that the proposed method has outperformed the formers in terms of image fusion. The comparison included the various metrics, such as correlation (CORR), MI, EN, QE, QAB/F, SD, root mean square error (RMSE), AG, and SF. Hence, based on objective and subjective evaluations, the proposed technique is promising for fusion multi-focus images.
Keywords:	DMWT, Image Processing, Image-fusion, Multi-focus, WLT, FFT.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	INTERPLAY BETWEEN COGNITIVE STYLES AND GENDER OF TWO HYBRID LEARNING TO LEARNING ACHIEVEMENTS
Author:	ANTHONY ANGGRAWAN, CHE KU NURAINI, MAYADI, CHRISTOFER SATRIA
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
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	A STRATEGIC FORECASTING APPROACH TO IMPROVE FUTURE INTER-URBAN MOBILITY POLICIES
Author:	MOHAMED EL HADRAOUI, FOUZIA GHATTI

Abstract:	Infrastructure has always played a vital role in the development of economies, and in this case, transport infrastructure. The latter constitute the support vector for intra- and inter-region mobility. Transport and mobility are becoming increasingly important in the sustainable management of land and are at the heart of the current debate. The modes of transport compete for the search for original and innovative solutions to stand out, increase their attractiveness and their competitiveness, and thus acquire an image that evokes development, modernity and respect for the environment. Given the various crises that the world has experienced and continue to experience, such as the 2008 financial crisis and the COVID-19 coronavirus pandemic, financial resources are becoming increasingly scarce. For that reason, solutions must be sought for a rational and judicious use of space as well as transport via a good control of mobility within the territory. Contrary to the various works carried out before, this paper is an attempt to create a tool to help strategic decision for national interurban mobility through the application, and for the first time in Morocco, of a dynamic modeling approach. It is about using a four-step modeling method, mounted on the TransCAD software, GIS-package with specific transportation analysis tools, supported with a certain flexibility in the configuration. Our contribution consists in investigating whether the proposed approach could succeed in the Moroccan context and contribute to the application of a dynamic modeling method, which links interurban mobility, all modes of transport, to the socio-economic parameters. That is using a Moroccan detailed, which is made up of the travel diary in 2016, enriched with many individual and domestic functions and data from the last General Population and Housing Census of 2014. This will give decision-makers better visibility on interurban mobility in Morocco.
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Keywords:	Four-Step Modeling, Inter-urban Mobility, Mode Choice Prediction, Utility Function, Gravity Model, Multinomial Logit Model, and Linear Regression
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	POWER SYSTEM SECURITY EVALUATION USING COMPOSITE LOGIC CRITERIA
Author:	PADMANABHA RAJU CHINDA, RAGALEELA DALAPATI RAO

Abstract:	An important problem in a big integrated power system is an evaluation of the power system security. Machine safety may be categorized based on key roles in control centers, such as the management of the system, the review of contingency, and the assessment of protection. Contingency analysis is the core factor of the threat evaluation. Every contingency cannot trigger the same degree of seriousness in real-time. The concept of severity and performance indexes seems to satisfy this desire to exclude non-violation cases and pick only crucial cases, known as a contingency analysis. Protection improvement includes an optimum flow of power, which is guaranteed by preventative control steps and correcting measures that ensure that the system operates as normal, in the presence of contingencies. Controllable measures to minimize special objective functions including fuel costs, mixed logical parameters, and weighted multi-objective indexes according to operating power system constraints are recommended in the Evolutionary Particular Swarm Optimization Method, which is combined with Interior Point Method. This paper presents IEEE 30 & 39 Bus Security Evaluation simulation findings. We are looking at soft computing strategies to evaluate power system safety.
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Keywords:	Power system security, Contingency analysis, Static security assessment, composite logic criteria, IPM-EPSO.
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	USER SATISFACTION INDEX OF E-HAILING SERVICES BASED ON CO-CREATION VALUE
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Author:	RUZZAKIAH JENAL, HAZURA MOHAMED, SITI AISHAH HANAWI, NUR ATHIRAH NABILA MOHD IDROS
Abstract:	E-hailing is a service that allows users to book a journey online and provides a platform for users to interact with e-hailing companies. The interaction between users as service recipients and e-hailing companies as service providers creates a co-creation value concept. However, studies on user satisfaction with e-hailing services have received less attention. Therefore, a study conducts to measure the satisfaction index of e-hailing services based on the co-creation value. The study uses the co-creation value model, the DART model, as the basis for improving e-hailing services through user satisfaction. The DART model, which consists of four factors, namely dialogue, access, risk assessment, and transparency, is a determining factor in e-hailing service user satisfaction. A survey of 251 users of e-hailing services conducts through an online questionnaire survey, and data from the questionnaires were analyzed. The e-hailing user satisfaction index results of 78.34% indicate that users are satisfied with the e-hailing services provided. It hopes that this study can be a guide for quality e-hailing services.
Keywords:	E-Services, Transportation Services, Service Quality, Satisfaction Index, User Satisfaction Model, DART Model
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	A REVIEW OF CRYPTOGRAPHIC IMPACT IN CYBER-SECURITY ON SMART GRID: THREAT, CHALLENGES AND COUNTERMEASURES
Author:	MD MEHEDI HASAN, NOOR AFIZA MOHD ARIFFIN, NOR FAZLIDA MOHD SANI
Abstract:	The continuous development of information communication technology assists the traditional electricity grid to become a modern integrated platform. As Internet-of-Things technologies involve in smart grid features together with delivery emerging services utility side to end user via unreliable channel. Due to high dependency of communication system lead catastrophic security vulnerabilities. In addition, loss data security or privacy along hampered core security objectives confidentiality, integrity, availability and broken connection between them. Therefore, significant number of researches worked mitigates those types of threads by the use of cryptographic aspect. It is fascinated to kept data secure and ensures the privacy between two parties during transmission or any kind of data share in distribute manner. In this paper, we present comprehensive survey on cryptographic impact in smart grid for security objectives, requirement, and challenges. Particularly, produces security threats, examined current research work countermeasure technique. We aim to supply deeper understanding about role of cryptographic aspect in smart grid to shed light and guide future research direction for cyber-security protection against from malicious attacker in smart grid application.
Keywords:	Smart Grid, IoT, Cyber-Security, Threats, Authentication, Cryptography
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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Title:	METHODOLOGY ASSESSMENT FRAMEWORK (MAF)
Author:	EBRU DALBUDAK , KARIM EL GUEMHIOUI , AHMED LAKHSSASSI , REJEAN GRAVEL
Abstract:	Selecting the appropriate SDM for a project is one of the most important steps to ensure the project success [1, 2]. There are so many SDMs in the market but how do we choose the right one? How do we determine and measure the concept of \diamond fit \diamond between the chosen SDM and the project? This research introduces a new framework called Methodology Assessment Framework (MAF) which helps decision makers assess a given project against the seven factors and determine the type of SDM that would be best suited whether it be an agile, plan-driven methodology or a hybrid of the two. This tool is based on seven decision factors, which are outcomes, scope, CYNEFIN (complexity), constituents, agile principles, team knowledge & experience, and organization capability & maturity. The paper explains each of the seven factors that MAF uses along with their assessment metrics to appraise a given project and based on the evaluation results, suggests whether the project should be run using an agile or plan-driven methodology. Next, it presents a cases study which demonstrates the application of this new framework into an Electronic Design Automation (EDA) tool development project, it identifies the agile/iterative methodology as the most suited SDM for the project.
Keywords:	Systems Development Methodology, SDM, Methodology, Agile, Framework
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Title:	IDENTIFICATION OF THE FISH SURVIVAL RATE AND THE FISH TYPES TO LIVE IN LAKE TOBA USING MACHINE LEARNING
Author:	ROMI FADILLAH RAHMAT, SARAH PURNAMAWATI, TIFANI ZATA LINI, RIDHO FARIHA, NABILA DEANNA, INDRA AULIA, SHARFINA FAZA

Abstract:	Waste disposal in Lake Toba conducted by the local citizens has led to water pollution and the decreasing number of freshwater fish. Therefore, the identification of water content is mandatory to ensure the survival and cultivation of the fish in Lake Toba. We conducted two studies using the same data using machine learning methods of Long Short-Term Memory and Support Vector Machine. These studies proved that both methods were reliable in the identification process. The results of this research showed that the water contents in Lake Toba are still good enough for the freshwater fish to live and the types of fish that have to highest chance to survive in Lake Toba.
Keywords:	Identification, Freshwater Fish, Machine Learning, LSTM, SVM
Source:	Journal of Theoretical and Applied Information Technology 31 st May 2021 -- Vol. 99. No. 10 -- 2021

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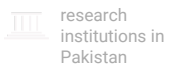
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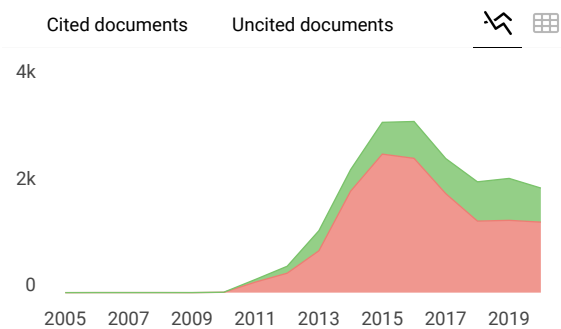
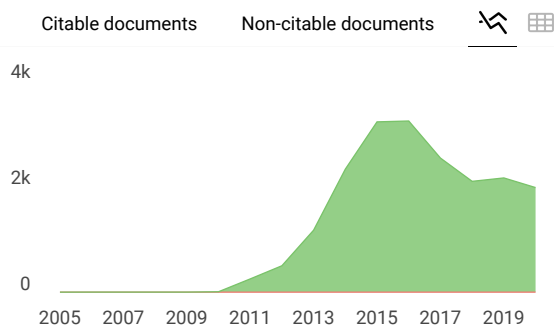
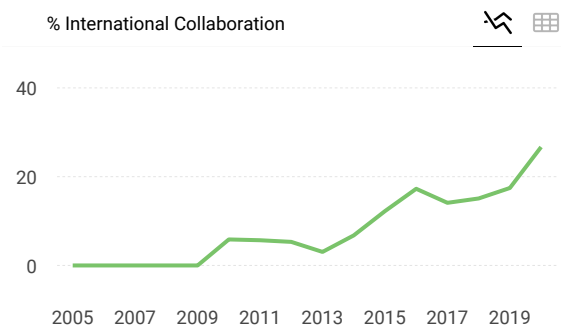
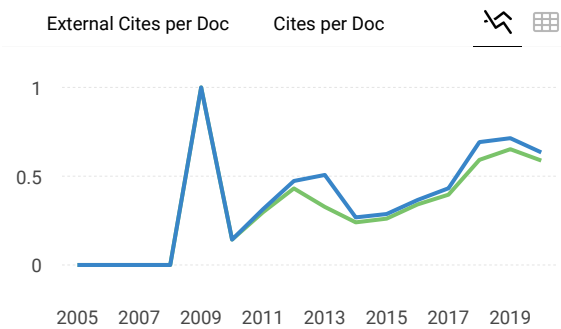
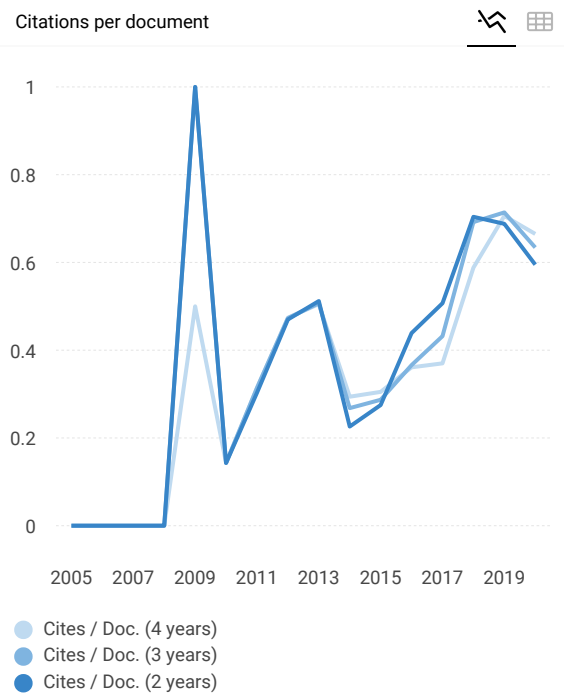
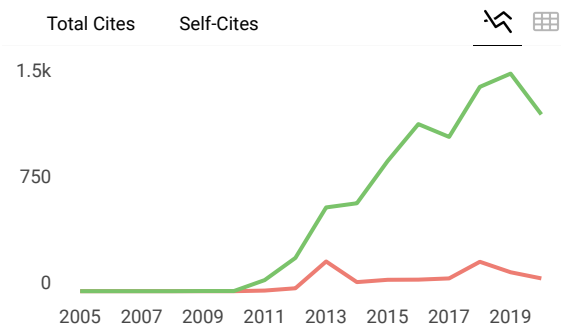
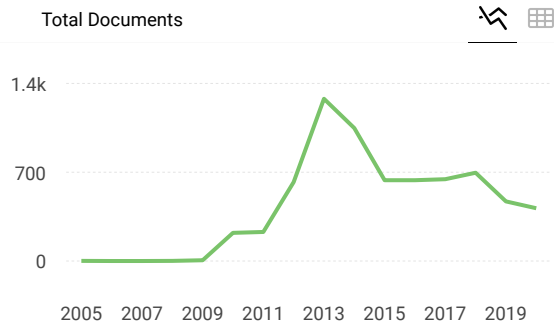
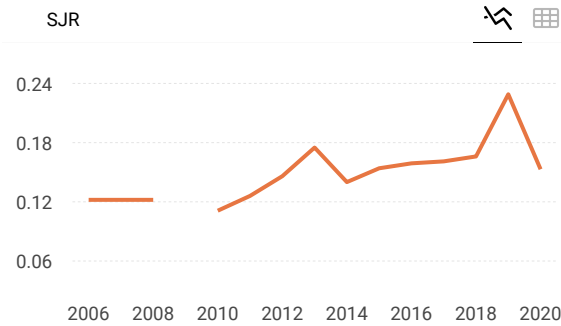
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Dear Aadil,

Thank you for contacting us. You need to consider the scientometric indicators of the year in which the article was published.

Therefore, if your article was published in 2020, it inherits all the scientometric indicators and quartile shown for the year 2020, which were released by SCImago in 2021.

Best Regards, SCImago Team

M **mayar** 8 months ago

Dear Sir

Is this journal still in Scopus database 2021 ?

reply



Melanie Ortiz 8 months ago

SCImago Team

Dear Mayar, thank you very much for your comment. We suggest you consult the Scopus database directly. Keep in mind that the SJR is a static image (the update is made one time per year) of a database (Scopus) which is changing every day.

Best Regards, SCImago Team

N **NADIA GAMAL** 11 months ago

where can I get the template for this Journal, Please ?

reply



Melanie Ortiz 10 months ago

SCImago Team

Dear Nadia,

thank you for contacting us.

We suggest you visit the journal's homepage (See submission/author guidelines) or contact the journal's editorial staff , so they could inform you more deeply.

Best Regards, SCImago Team

D **Dr samira khan** 11 months ago

How to submit paper and how much time it will take for publishing

reply

K **khalid** 3 months ago

It takes from 15 dayes to 2 months for the response . if accepted, it depends on available slots (nearly 2 months for me.



Melanie Ortiz 11 months ago

SCImago Team

Dear Dr. Samira, thank you very much for your comment, we suggest you look for author's instructions/submission guidelines in the journal's website. Best Regards, SCImago Team

S **Salaheddin J Juneidi** 12 months ago

Dear

I see that JATIT is in a predatory journal list <https://predatoryjournals.com/>, how come it is listed predatory and at the same time indexed by you .

reply

A **Atif Ikram** 11 months ago

Dear Salaheddin J Juneidi,

This Journal is continually indexed in Scopus from 2009 (onwards till now).

<https://www.scopus.com/sourceid/19700182903>

In 2009, this journal has a Scite Score of 1.2 and now has quartile Q3. Hopefully, it will be Q2 in near future, as its citations are growing very quickly. So, I think this journal is a good option to publish a research paper.



Melanie Ortiz 12 months ago

SCImago Team

Dear Salaheddin,
thank you for your comment.

Our data source is Scopus, SCImago doesn't participate in the journal's selection. SCImago has no authority to include or exclude SJR journals. We just show the data provided in the latest update by Scopus. Please contact Scopus Support regarding this matter here:

https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/

Best Regards, SCImago Team

K **KWANGSOO JANG** 1 year ago

Can you tell me how long it usually takes for a blind peer review?

reply

K **KWANGSOO JANG** 1 year ago

I sent an email to the editor, but there is no reply. Can I ask for help?



Melanie Ortiz 1 year ago

SCImago Team

Dear Kwangsoo,
Thank you for contacting us.
Unfortunately, we cannot help you regarding this matter.
Best Regards, SCImago Team



Melanie Ortiz 1 year ago

SCImago Team

Dear Kwangsoo,
thank you for contacting us.
Unfortunately, we cannot help you with your request, we suggest you visit the journal's homepage or contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

A **aymen** 1 year ago

my grant will be expired in Oct. my question is if i send my article after 5 days could you respond for within less than a month. so i can pay the fee of publication

reply



Melanie Ortiz 1 year ago

SCImago Team

Dear Aymen, thank you very much for your comment. Unfortunately, we cannot help you with your request, we suggest you contact the journal's editorial staff so they could inform you more deeply. Best Regards, SCImago Team

M **Motahareh zarefard** 1 year ago

My paper titled "THE INFLUENCE OF ENTREPRENEURIAL COMPETENCIES OF PROJECT LEADER ON INNOVATIVE IDEA GENERATION IN THE ICT FIRMS " was published by the Journal of Theoretical and Applied Information Technology, 2019.

I have shared and cited this paper many times, but I can not find it through Google Scholar.com or

by googling!

How can I cite it in my future papers?

reply



Melanie Ortiz 1 year ago

SCImago Team

Dear Motahareh,
thank you for contacting us.
Unfortunately, we cannot help you with your request, we suggest you contact the journal's editorial staff, so they could inform you more deeply.
Best Regards, SCImago Team

H **Hussein** 1 year ago

This journal is a predator, unfortunately i wasn't aware before publishing there, they accepted my manuscript in 5 days and they did not give me any revisions, they just publish the manuscript as is! please remove those journals and make an easy way to report them, regards.

reply



Melanie Ortiz 1 year ago

SCImago Team

Dear Hussein,

Thank you for contacting us.
SJR is a portal with scientometric indicators of journals indexed in Scopus. All the data have been provided by Scopus /Elsevier and SCImago doesn't have the authority over this data which are property of Scopus/Elsevier. SCImago has a signed agreement that limits our performance to the generation of scientometric indicators derived from the metadata sent in the last update. We suggest you contact with Scopus support regarding this matter here:
https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/

Best Regards, SCImago Team

J **Johanes Fernandes Andry** 1 year ago

dear Admin or teams Scimago,
is the International Journal of Advanced Trends in Computer Science and Engineering (IJATCSE) ISSN (ONLINE) : 2278 – 3091 is SCImago Journal and Country Rank in year 2020?

best regards n thanks
JF Andry

reply

SCImago Team

**Melanie Ortiz** 1 year ago

Dear Johanes,

Thank you for contacting us. Our data come from Scopus, they annually send us an update of the data. This update is sent to us around April / May every year. Thus, the indicators for 2019 will be available in June 2020 and before that date we can't know what will happen with this journal. Best Regards, SCImago Team

A **Ayman asfoor** 2 years ago

is the JOURNAL OF THEORETICAL AND APPLIED INFORMATION TECHNOLOGY is scopus indexed in year 2020

reply

**Melanie Ortiz** 2 years ago

SCImago Team

Dear Ayman, thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you to consult the Scopus database directly. Keep in mind that the SJR is a static image (the update is made one time per year) of a database (Scopus) which is changing every day.

Best Regards, SCImago Team

N **Noor** 2 years ago

Hi,

Just to confirm this journal: Journal of Theoretical and Applied Information Technology is ISI journal Q3?

Or this journal is a SCOPUS journal?

Thanks

reply

A **Atif Ikram** 2 years ago

Hi, Noor,

This Journal is Scopus indexed only but not ISI impact factor journal.

**Melanie Ortiz** 2 years ago

SCImago Team

Dear Noor,

Thank you for contacting us. SJCR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus and our indicator is the SJR. We suggest you to consult Scopus database (see the current status of the journal) and check our website to see the

indicators of this journal. We suggest you to consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source.

Best Regards, SCImago Team

A **Atif** 2 years ago

Dear Elena Corera,

I have seen comments of different people on this and on other journals. Many of the times, they are asking very strange questions, like "What will happen to this journal in future? " "Is this journal is good?"

I salute you, the way you treat these kind of questions.

Most of the questions are not related to you , but those are related to directly Editor of any journal.

I think if someone is going to publish a paper, he / she should have maturity in his level of thinking.

Great Job by you. Good Luck.

reply

M **Muhammad** 2 years ago

This journal is still covered by Scopus. I just confirmed from 2020 listing of scopus



Melanie Ortiz 2 years ago

SCImago Team

Dear users,

you'll find the Scopus profile of this journal here (see the Scopus coverage years):

<https://www.scopus.com/sourceid/19700182903>

Best regards, SCImago Team

O **opwox** 2 years ago

Also predatory journal, it impossible more than 8 years and the IF of the journal still low. at first it was only 40 and 100 US dolar and actually 300 and 250 US dollars.

reply



Melanie Ortiz 2 years ago

SCImago Team

Dear user, SJR is a portal with scientometric indicators of journals indexed in Scopus. SJR has no authority over the data of the journals; they are the ones that Scopus sends us. In

this link more information on predatory journals: <https://beallslist.weebly.com/>. Best regards, SCImago Team

R **Rupali** 3 years ago

I have submitted paper on October still it is showing it is under review process.how much time it will take to accept and publish paper?

reply



Elena Corera 3 years ago

SCImago Team

Please, contact Journal of Theoretical and Applied Information Technology, you are contacting Scimago Journal and Country Rank.

Best,
SCImago Team

D **Dr Mokhled AlTarawneh** 3 years ago

Hello Dear
I submitted a paper to this journal and i got empty confirmation file
Successful Manuscript Submission to JATIT
but no response

reply

D **Dr.rasha** 3 years ago

Hello my research was accepted in this journal but I need from them confirmation about receiving the payment

reply

S **sandeep shelke** 9 months ago

Hello,
So finally whether your paper published in this journal ?
How long does it took to publish after payment ?

D **Dr. Huda Abdulaali** 3 years ago

I want to publish in this journal, Can you please tell whether this Journal indexed in Scopus in 2017-2018? Yes or no?

reply

SCImago Team

**Elena Corera** 3 years ago

Dear Dr Huda Abdulaali,

thank you very much for your comment, unfortunately we cannot help you with your request. We suggest you check author's instructions in journal website. You can find that information in SJR website <https://www.scimagojr.com>

Best Regards,
SCImago Team

E EL HASSANE LAAJI 3 years ago

Hello,

I want to ask you, if it is possible to publish in journal.

my thesis subject is "Lattice Based cryptography", and my paper is a benchmarking between two best cryptosystems based en Lattices(NTRUencrypt and Newhope) the both are submitted in NIST competition.

Thanks

reply

**Elena Corera** 3 years ago

SCImago Team

Dear El Hassane Laaji,

thank you very much for your comment. Unfortunately, we cannot help you with your request, we suggest you contact journal's editorial staff so they could inform you more deeply. You can find contact information in SJR website <https://www.scimagojr.com>

Anyway, if there is any user who has already published in the journal, maybe could help us with your request.

Best Regards,
SCImago Team

S sonal Bhise 3 years ago

I want to publish in this journal, Can you please tell whether this Journal indexed in Scopus? Yes or no?

reply

**Elena Corera** 3 years ago

SCImago Team

Dear Sonal,

thank you for your request, all the journals included in SJR are indexed in Scopus. Elsevier / Scopus is our data provider.

Best Regards,

SCImago Team
Coverage 2010-ongoing

E **Elangovan P** 3 years ago

What is the impact factor of this journal?

reply



Elena Corera 3 years ago

SCImago Team

Dear Elangovan, SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR. Check our page to locate the journal. We suggest you consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. Best Regards, SCImago Team



Wakhinuddin S 3 years ago

Thanks for publishing, we have article: UTILIZATION OF OPEN SOURCE TECHNOLOGY IN DETERMINING OF VALIDITY AND RELIABILITY OF EVALUATION MODEL INSTRUMENTS BASED ON ANEKA VALUES IN ORDER TO EVALUATE THE QUALITY OF ...

I together with DEWA GEDE HENDRA DIVAYANA, ANAK AGUNG GEDE AGUNG, BASO INTANG SAPPAILE, WAKHINUDDIN SIMATUPANG.

I am Wakhinuddin S. I have article about Problem based learning and e-Assessment impact to achieve student. Now, still to prepare this article, I shall send to Jatit journal. Thank you.

reply

M **mari** 2 years ago

please how cost the fee publication,?



Elena Corera 3 years ago

SCImago Team

Dear Wakhinuddin, we suggest you locate the author's instructions on the journal's website. Best Regards, SCImago Team

H **Hitapriya Suprayitno** 3 years ago

What does the number 0.16 indicates ?

reply

SCImago Team

**Elena Corera** 3 years ago

Dear Hitapriya, SJR (SCImago Journal Rank) indicator
It expresses the average number of weighted citations received in the selected year by the documents published in the selected journal in the three previous years, -i.e. weighted citations received in year X to documents published in the journal in years X-1, X-2 and X-3. See detailed description of SJR (PDF).

R **Ramgouda** 3 years ago

Is JATIT a Scopus indexed journal in 2018

reply

**Elena Corera** 3 years ago

SCImago Team

Dear Ramgouda, we can not see what will happen in the future with this journal. SCImago receives the data from Scopus / Elsevier annually and does not have the authority to include, exclude or modify the data provided by Scopus. Best Regards, SCImago Team

**Elena Corera** 3 years ago

SCImago Team

Dear Ramgouda, we can not see what will happen in the future with this magazine. SCImago receives the data from Scopus / Elsevier annually and does not have the authority to include, exclude or modify the data provided by Scopus. Best Regards, SCImago Team

R **Ramgouda** 3 years ago

is this journal is scopus indexed in 2018

reply

**Elena Corera** 3 years ago

SCImago Team

Dear Ramgouda, the publication of articles of 2018 is not over yet (we are in August), and much less it has been possible to cite unpublished articles. The 2018 indicators will not be available until June 2019. Best Regards, SCImago Team

Leave a comment

Name

Email

(will not be published)

I'm not a robot reCAPTCHA
Privacy - Terms

Submit

The users of Scimago Journal & Country Rank have the possibility to dialogue through comments linked to a specific journal. The purpose is to have a forum in which general doubts about the processes of publication in the journal, experiences and other issues derived from the publication of papers are resolved. For topics on particular articles, maintain the dialogue through the usual channels with your editor.

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