The Role of Blended Learning in Improving Students' Numerical Ability and Learning Creativity

El papel del aprendizaje mixto en la mejora de la capacidad numérica y la creatividad en el aprendizaje de los estudiantes

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Abstract

Research exploring the potential benefits of blended learning in enhancing numeracy and creativity is imperative. This study aims to evaluate the impacts of the blended learning approach on both numerical proficiency and creative learning of students. Using the quasi-experimental model, the investigation involved 60 secondary students during the spring semester, divided into experimental and control groups. Data collection used questionnaires and tests, with analysis performed using SPSS 29 and Winstep software. The findings reveal a significant influence of the blended learning model on numerical ability, even when considering the creative learning of the students. Additionally, creative learning by students significantly affects numerical ability. These results underscore the importance of implementing blended learning in high schools, as it fosters the development of both numerical skills and creativity.

Keywords: Acquisition of Information, Blended Learning, Creativity, Experiment, Numerical ability, Rasch measurement, Seeking of Information, Synthesizing of Knowledge.

Resumen

La investigación sobre los posibles beneficios del aprendizaje mixto en la mejora de la capacidad numérica y la creatividad es imprescindible. Este estudio tiene como objetivo evaluar los impactos del enfoque de aprendizaje mixto en la competencia numérica y el aprendizaje creativo de los estudiantes. Utilizando el modelo cuasi-experimental, la investigación involucró a 60 estudiantes de secundaria durante el semestre de primavera, divididos en grupos experimentales y de control. La recolección de datos se realizó mediante cuestionarios y pruebas, con un análisis realizado utilizando el software SPSS 29 y Winstep. Los hallazgos revelan una influencia significativa del modelo de aprendizaje mixto en la habilidad numérica, incluso considerando el aprendizaje creativo de los estudiantes. Además, el aprendizaje creativo por parte de los estudiantes afecta significativamente la habilidad numérica. Estos resultados subrayan la importancia de implementar el aprendizaje mixto en las escuelas secundarias, ya que fomenta el desarrollo tanto de habilidades numéricas como de creatividad.

Palabras clave: Adquisición de información, aprendizaje combinado, creatividad, experimento, habilidad numérica, medición de Rasch, búsqueda de información, síntesis de conocimiento

1. Introduction

As learning technology evolves over time, the educational system must often adopt a new paradigm to remain relevant. Combining synchronous and asynchronous learning with new electronic educational media is an example of a new teaching style (Mitchell & Forer, 2010). In science, engineering, and information technology, this blended learning technique (B-learning) can combine face-to-face training with computer-mediated instruction.

B-learning is the "third generation" of distance learning systems. The first generation used a one-way delivery method for instruction, such as mail, radio, and television. Distance learning using a single technology, such as computer- or web-based learning, was the second generation. The third generation is b-learning, which is characterised by taking advantage of face-to-face learning and numerous learning technologies.

The improvement of B-learning can be related to different learning goals. Numerous studies on blended learning models (Aliftika et al., 2021; Marito & Riani, 2022) have indicated that blended learning models can enhance critical thinking and autonomous learning skills. However, the sample utilised in his study was from higher education; therefore, it is unknown whether the strategy increases cognitive ability at the secondary level. Additionally, blended learning may enhance student innovation and learning results (Francis & Shannon, 2013; Suryani et al., 2021). However, there is no indication of the research learning outcomes' capability. Meanwhile, Capone (2022) and Indrapangastuti et al. (2021) discovered that a blended learning can boost students' motivation and achievement. This study focusses solely on cognitive capabilities due to the absence of controlled external variables, which is evidently a flaw. No one has previously studied the effects of B-learning approaches and learning creativity on student numeracy.

Another research by Owston et al. (2013) examined two one-year professional development programmemes (TeL-Teacher eLearning Project) that used the blended paradigm for 133 middle school mathematics or science/technology teachers. The programmeme implementation model consisted of two to three modules. Each module consisted of face-to-face meetings followed by online sessions and had a specific theme. Instructors with specialised knowledge were used to facilitate online discussions. The results suggest that the programme had a positive impact on instructors' attitudes, expertise, and motivation to change their practices. However, while it was agreed that the face-to-face component was extremely beneficial, there was a mixed response to the online sessions and participation in the biweekly reflection task was low. In other research, a systematic review was done (Al-Maroof et al., 2021). The fact that previous studies on blended learning offered valuable insight into B-learning research led to the conclusion that blended learning is the predominant model to predict individual learning intentions, while B-learning research has not yet been comprehensively studied from different perspectives.

In the age of information with changing living conditions, creative thinking skills have gained great importance in all walks of life, especially in the business world. Creative thinking is not a luxury, but a requirement that should not be neglected. One of the best experiences for high school students is the opportunity to think freely and to compare other students' ideas with their own. The Upper School aims to teach and develop students' creative thinking skills (CT). Not only CT, but also the other skill (i.e., numerical ability) is a fundamental skill in education.

Numerical ability deals with numbers, mathematical calculations, patterns, and logical and scientific thinking (Ndiung et al., 2019). This statement shows that numerical ability, as a basic skill in dealing with numbers and numerals, is certainly an important factor in the study of mathematics and in everyday life (Hawes et al., 2017). Numerical skills are mathematical skills that include the ability to perform calculations such as addition, subtraction, multiplication, and division; to increase; to draw roots; to draw logarithms; and to manipulate numbers and symbols in mathematics (Namkung et al., 2018; Rousselle & Noël, 2007).

The study of mathematics will be easier for those who have strong numerical ability (Hutchison et al., 2019; Raghubar & Barnes, 2017). Several problems have been identified as obstacles to learning mathematics. One of these is the difficulty in developing numerical skills, especially computational skills (Supriadi et al., 2021). Given the significance of numerical skills, it is crucial to enhance them to facilitate the mathematics learning process, learn creativity, and fulfil learning objectives.

Numerical ability is also correlated with learning creativity. According to a study by Nakano et al. (2021), there is a favourable and statistically significant correlation between creativity and intelligence (i.e., numerical). Learning creativity is the ability of students to develop novel solutions to learning-related problems (Cheng, 2011; Komarudin et al., 2020). Learning creativity can be considered as a technique that shapes students' personality toward creativity, creative thinking, and behaviour change during the learning process. During the learning process, students can express all their creative ideas. Learning achievement can be predicted by the creativity of the student in learning (Supena et al., 2021). Creativity in learning correlates favourably with numerical ability; therefore, it is important to focus on creativity (Gunawan et al., 2018; Tzachrista et al., 2023).

Although there are several studies on creativity in learning, relatively few have examined the effects of creativity on numerical ability, particularly in mathematics. No one has yet investigated the impact of the B-learning approach and learning creativity on students' numerical skills. Therefore, this study aims to show the effects of the B-learning model and learning creativity on the numerical ability of high school students.

2. Theoretical Background

B-learning

B-learning, which has been gaining popularity in elementary schools, is characterised by mixing teacher-led instruction with digital technology (Crawford, 2017). In a recent review, Amenduni & Ligorio (2022) define B-learning as the combination of in-person and online training. Similarly, B-learning generally refers to any combination of learning techniques, with a predominance of face-to-face instruction and asynchronous and/or synchronous computer technologies. Another term used synonymously with blended learning is hybrid learning (Li et al., 2021).

Students have access to digital resources at multiple times and locations, and teachers can use online activities to adjust their instruction to meet the needs of each student, especially those at risk of academic failure. In fact, teachers can use the real-time performance data of the digital component to provide personalised education. According to Salo et al. (2022), customised education focussing on skill gaps can produce encouraging outcomes for at-risk adolescents struggling with early reading.

Some studies of middle and high school educational programmes incorporate b-learning. For example, Iqbal et al. (2022) there are links between social abilities and study habits through cognitive (i..e., mathematical) engagement in blended learning contexts. In other words, Suggate & Lenhard (2022) compared two programmes to improve reading comprehension of sixth graders. The first strategy was taught by teachers and taught multiple strategies to develop summarization skills, while the second approach used the digital programme conText to provide constructive comments on written summaries. In other research in B-learning classrooms, students have access to the digital curriculum and receive traditional education in a physical location; therefore, adopting intricately mixed learning requires working closely with teachers to define classroom rhythms and patterns. The findings demonstrated that a B learning environment in a primary classroom promotes student participation when teachers are equipped with the appropriate competencies. In regard to the B-learning steps that make successful of cognitive process. B-learning consists of three steps (Syahrawati et al., 2022). The first stage is the search for information, which involves searching for information from various sources on the Internet, in books, and elsewhere, as well as making critical selections among the information sources based on their relevance, validity/reliability, and academic clarity. The teacher acts as a subject matter expert who can provide feedback and advise using information and communication technologies. The second stage is the acquisition of information. Individually and in groups, students must be able to find, understand and apply preexisting ideas or concepts and then analyse information or knowledge from many available sources until they can communicate and interpret those concepts. The third stage of knowledge synthesis. This phase is the reconstruction or formulation of knowledge through a process of assimilation and accommodation that begins with the results of analysis, discussion, and the formulation of conclusions from the information obtained.

Numerical Ability

It has been suggested that the ability to recognise and non-verbally quantify the objects of a set (i.e., its numerosity) is a key domain-specific precursor for the development of numerical and arithmetic skills (Piazza, 2011). This development has been linked to two neurocognitive systems: the approximate number system and the object-tracking system (Vogel & De Smedt, 2021). Early infancy reveals significant individual variability and developmental changes in both systems. Although it is accepted that these systems provide a vital foundation for seeing quantities, their causal association with the development of symbolic numerical and mathematical skills is contested (Leibovich & Ansari, 2016; Wilkey & Ansari, 2020).

Regarding the development of numerical cognition in individuals, a path can be traced from the basic abilities to formal education in school context that begins later in infancy (Ponticorvo et al., 2022). Even if the starting point is comparable, there are many possible results in numerical and subsequent mathematical achievement: disparities in maths achievement are frequently reported by age, gender (Suherman et al., 2020), and culture (Hartinah et al., 2019). These observed differences cannot be attributed to the presence or absence of the natural endowment for dealing with numerical knowledge, as it is shared by humans (and other species), so it is likely that they are the result of other factors, most likely cultural, social, and educational factors.

Learning Creativity

Contextual learning allows students to participate directly in a process, strengthening their ability to seek, retain, and apply the knowledge they acquire (Liou et al., 2009). According to Csikszentmihalyi & Wolfe (2014), students' learning creativity is characterised not only as the ability to produce something new but also as the ability to synthesise ideas and implement them in a novel way. In other words, creativity is the capacity to create something new depending on the results of the thought process (Bruno & Canina, 2019). Something new associated with the product that is distinct from the prior invention and has innovation value (Yan & Li, 2022). Creativity was defined as the capacity of students to solve problems by demonstrating four indicators of thinking, namely: fluency (providing multiple solutions); flexibility (providing a variety of answers and points of view); originality (The capacity to develop ideas or concepts as a result of one's own thought process); and 4) elaboration (Ability to describe anything in great detail) (Suherman & Vidákovich, 2022).

3. Method

Research Design

The research team used a technique known as quasi-experimental design for the investigation. The quasi-experiment was carried out using a non-equivalent control group design. The independent variable is the B-learning model (X_1) and learning creativity (X_2), whereas the dependent variable is numerical ability in the material of numerical ability (Y). The material has been covered by the Republic of Indonesia Ministry of Education and Culture curriculum (Kementerian Pendidikan dan Kebudayaan RI, 2020). This study employed experimental and control classes. The experimental class using the B-learning model, while the control class received schooling that followed the Indonesian K-13 curriculum (t-learning). This study received approval from the Institutional Review Board of the Universitas Islam Negeri Raden Intan Lampung, Indonesia, ensuring compliance with ethical standards.

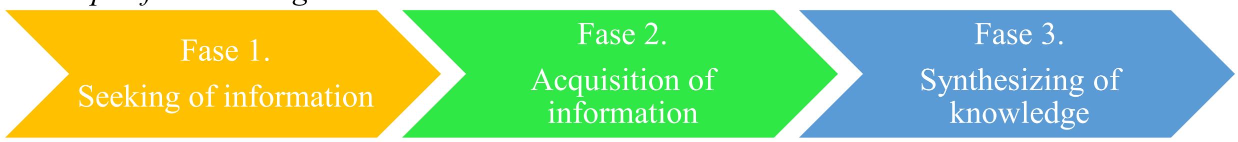
In an experimental design, researchers manipulate the independent variable to observe its effect on the dependent variable. In this study, the independent variable was the B-learning model, which was implemented in the experimental class. The dependent variable was the learning outcomes of the students, which were measured and compared between the experimental and control groups. To ensure that the observed differences in learning outcomes were indeed due to the B-learning model, the researchers included a control group in the study. The control group received traditional schooling that followed the Indonesian K-13 curriculum. This allowed the researchers to compare the performance of the experimental and control groups and isolate the effect of the independent variable on the dependent variable. Overall, the design of this study is a well-structured experimental design with a control group. This design allowed researchers to draw causal inferences about the effectiveness of the B-learning model on student learning outcomes.

In July and August 2022, the experimental group was assigned B-learning activities three times a week, based on the results of numerical literacy assessments that were administered to both the experimental and control groups. The B-learning technique involved group activities, including small groups of children who were separated by age, developmental stage, interests, and abilities, to design and market various products to their peers. According to previous research by Huda et al. (2019) and Yasin et al. (2020), small group activities are more efficient and effective for students than one-on-one training.

The activities resumed around 9:30 a.m. after a break and each activity was assigned a time of about 60 to 90 minutes. Before beginning the activities, the students participated in a vigorous play activity to help them release their pent-up energy. After completion of the 4-week B learning activities in the experimental and control groups, the numerical ability of the students was assessed and the results were compared between the two groups. Scale applications were carried out one-on-one in the teacher's room of the school, and each scale took around 20-25 minutes to implement. The applications were conducted through small group activities of four people using the design teaching model. When selecting the small groups, it was important to ensure a balance in terms of age, developmental stage, interests, and abilities so that students could achieve the same results in various ways (Henriksen et al., 2016).

In regard to the B-learning steps that make successful of cognitive process. The learning steps are available in Figure 1.

Figure 1
The Steps of B-Learning



Participant

This study involved 225 students. The 60 students were assigned using a non-random method in the ninth grade of a secondary school in Lampung province, Indonesia. The average age of the students was 16.70 years (*SD* = 0.77), with thirty students studying both the B-learning model and the traditional classroom model. This school was selected because it used limited face-to-face learning during the COVID-19 pandemic and 99 percent of its students already own Android devices, allowing the B-learning approach to be implemented. Table 1 displays the demographic information of the participant in this study:

Table 1

The demographics of the sample.

Demografi		Frequency	Percentage (%)
Gender	Male	27	45%
	Female	33	55%
Living place	City	3	5%
	Subburbs	57	95%
Ethnicity	Java	51	85%
	Lampung	6	10%
	Sunda	3	5%

Instruments

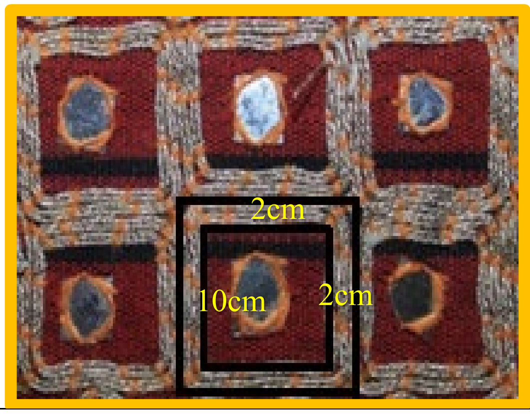
The instruments utilised in this study include questionnaires and essay tests, with the questionnaire measuring students' learning creativity and the essay test measuring students' numerical abilities. An example of the numerical test is shown in Figure 2. The scoring, based on students' abilities, ranged between 1 and 5.

Figure 2

An example of a numerical test.

A square-shaped *Tapis Kaca* with dimensions 10 cm x 10 cm has a cemented path of 2 cm along its length and a path of 2 cm along its width (as shown in the figure below).

a. Write the problem down into a question!
b. Write down the data you need!
c. Find the area of the shaded gold portion!



The learning creativity questionnaire was adapted from Susanto et al. (2018) and included subscales for fluency, flexibility, originality, and elaboration. The questionnaire consists of 20 statements with four possible responses; each response is assigned a score according to its degree on the Likert scale: strongly disagree (score 1), disagree (score 2), agree (score 3), and strongly agree (score 4). An example o the itmes are "thinking of new ways to help people" and "choosing the best solution to solve problems". We measured validity and reliability in this study.

Data Analysis

This data analysis using Winstep software version 5.2.3.0 and SPSS 26. The The Rasch model was part of a larger collection of measurement models known as item response theory (IRT) and was widely used in educational research to examine psychometric data (Khine, 2020) Rasch model offered a highly effective option for examining the psychometric characteristics of measurements and addressing response bias (Chan et al., 2021). With a significant threshold of 5%, the Kolmogorov-Smirnov normality and homogeneity tests were used as precondition tests before the main analyses could begin. Assume that the test results are normally distributed and that they are derived from the same or homogeneous variance areas in the population. In that case, the Analysis of Variance (ANOVA) test can be used to test statistical hypotheses.

4. Results

Validity and Reliability of Instruments

This section analyses the assessment tool used in this study. Table 2 indicates that the seven selected items demonstrate a high dependability score of .97. Additionally, the reliability parameters in the Rasch measurement model are .88 for person reliability and .97 for item reliability, reflecting strong consistency for both measures. Statistics representing good reliability (more than 0.67) (Fisher, 2007). Furthermore, the Cronbach Alpha was .87. Rasch's measurements correspond to Outfit MNSQ ranging from .76 to 1.38 and Outfit SZTD ranging from -1.68 to 1.60.

Table 2
Summary of measured person and item.

Object-Measured	Measure [Mean (SD)]	Separation	Reliability	Cronbach Alpha
Person	-.54 (1.66)	2.77	.88	.87
Item	.00 (1.17)	5.62	.97	

The bubble wrap plot (see Figure 3) displays item fit statistics for a set of items labeled C4, C5, and C7, categorized as numerical items. All items cluster around the 1.0 mark on the outfit mean-square scale, indicating reasonable fit to the measurement model. The items are represented as blue circles, with C5 positioned slightly higher on the measures scale compared to C4, and C7 positioned notably lower at around -2 on the measures scale, though all maintain similar outfit statistics.

Figure 3

Bubble wrap for item fit

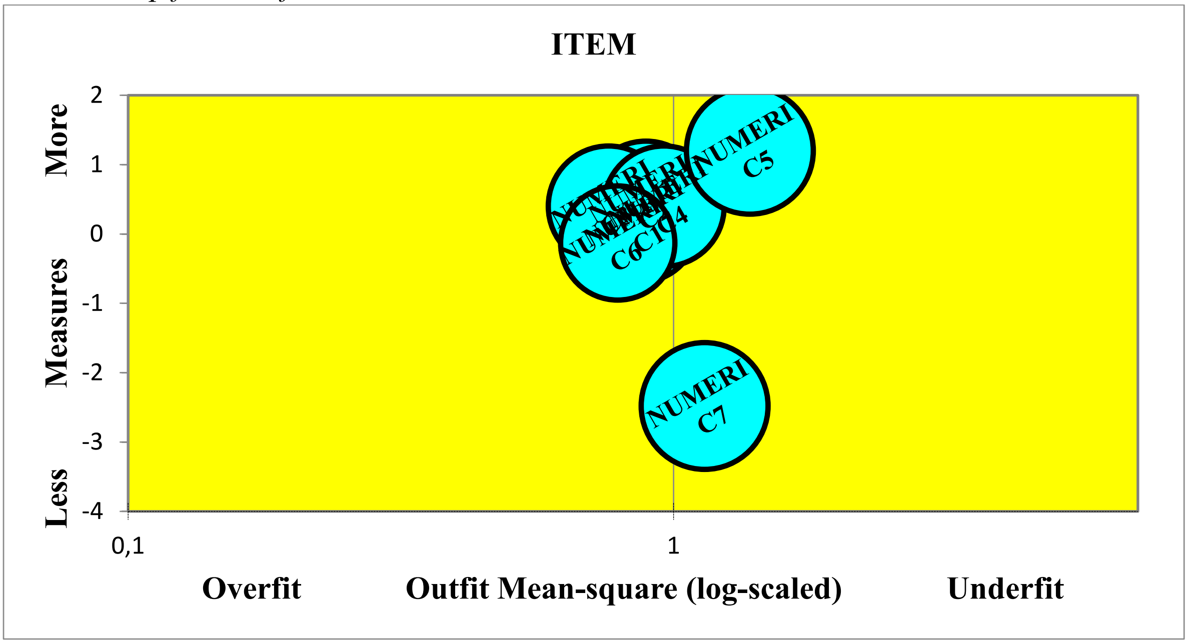


Figure 4 shows that question number 7, with a score of 0.55 logits, falls into the easy category for measuring numerical ability, while question number 5, with a score of 1.25 logits, belongs to the harder category. The distribution of all the items is shown in the Wright map in Figure 5. Notably, all seven questions are confirmed as valid and reliable according to Rasch's measurements.

Figure 4

The wrap map of easiest and hardest items question

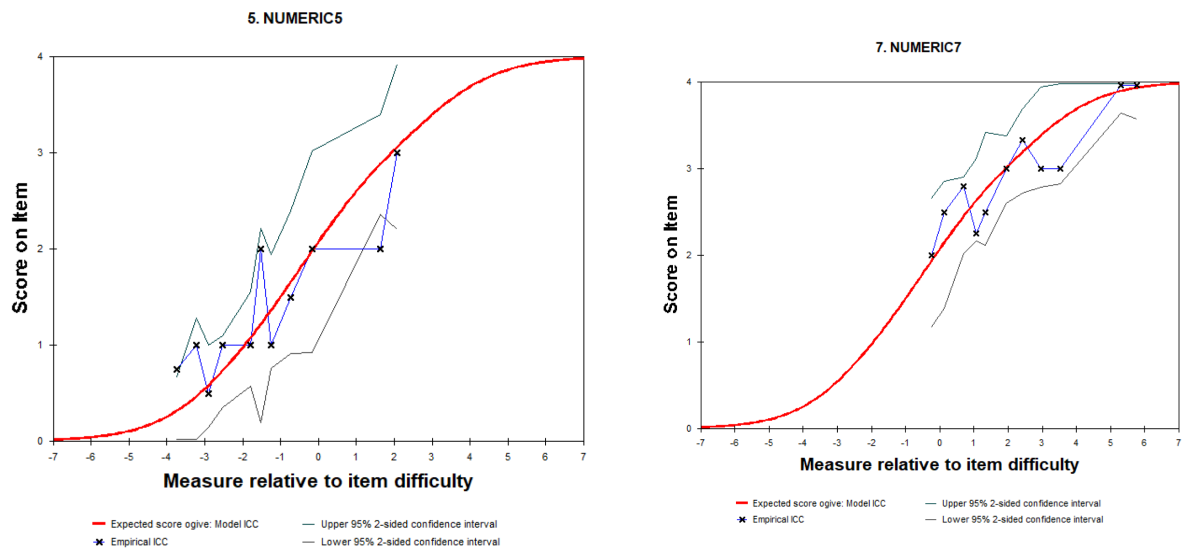


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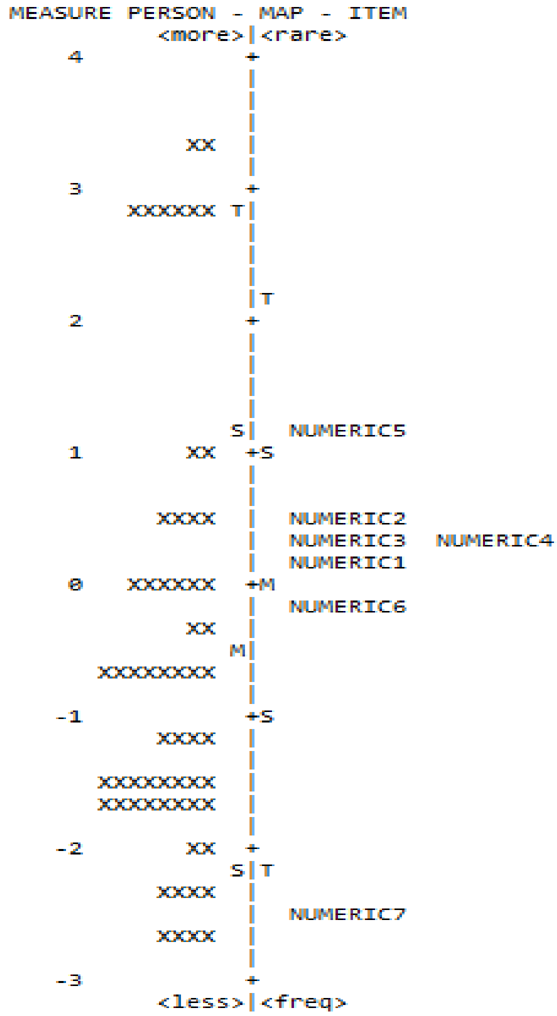
Figure 5

Map of question difficulty and student ability



As presented in Table 3, the 20-item questionnaire shows high reliability, with both the reliability coefficient and Cronbach's alpha at 0.91. Rasch analysis confirms item fit, with Outfit MNSQ values ranging from 0.66 to 1.29 and Outfit ZSTD values between -2.0 and 2.0. In other words, based on the eigenvalue, the raw variance explained by measures is approximately 39.4% and the variance in the first comparison is approximately 10.3%. In order for the questionnaire to be valid and reliable according to Rash's measurement.

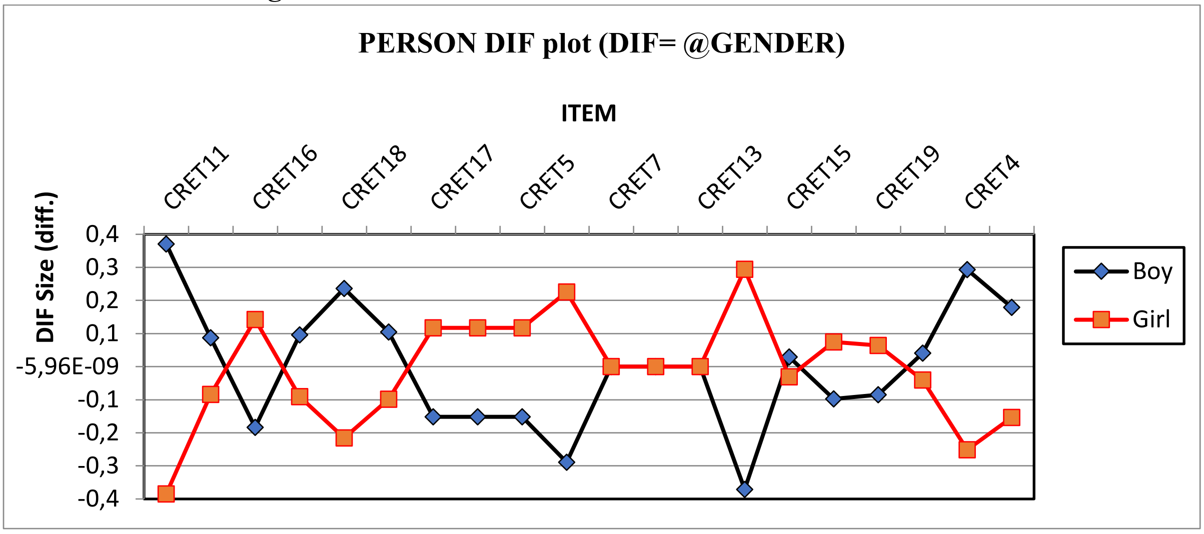
Table 3

Summary of measured person and item questionnaire

Object-Measured	Measure [Mean (SD)]	Separation	Reliability	Cronbach Alpha
Person	2.89 (1.44)	3.19	.91	.91
Item	.00 (.41)	1.26	.81	

The DIF analysis, conducted using Rasch analysis, aimed to evaluate the invariance of the questionnaire across different groups and determine whether specific items behaved differently between these groups. In this study, the focus was on measuring DIF based on gender. The DIF analysis was estimated using a significant probability ($p < .05$) and a large effect size (≥ .64). A significant result with a large effect size indicated the presence of DIF, while a nonsignificant result with a small effect size suggested no DIF, and a significant result with a small effect size indicated minimal bias between groups. As shown in Figure 6, no DIF was observed in this study.

Figure 6
The DIF item-based gender



Descriptive statistics

Below are critical remarks on the presentation of the results data analysis based on the numerical test and learning creativity. Table 4 reveals a notable difference between the students' average numerical ability (M = 82.05, SD = 5.67) and their learning creativity (M = 76.07, SD = 6.71), with $t(60) = 13.22$, $p < .001$, indicating statistical significance.

Table 4
Differences between the numerical ability of students of students and the creativity of the creativity of learning

Variables	*M*	*SD*	*t*(60)	*p*
Numerical Ability	82.05	5.67	13.22	<.001
Learning Creativity	76.07	6.71		

Table 5 indicates that the performance of the boys (M = 81.48, SD = 5.87) was significantly higher than that of the girls (M = 82.52, SD = 5.54), $t(60) = -.70$, $p < .01$. The normality test was conducted to examine whether the questionnaires and questions used to collect data from the experimental and control groups were normally distributed. The post-test data are used for the prerequisite test. Using SPSS 26 software, the Kolmogorov-Smirnov normality test was calculated for this investigation. The statistical results for learning creativity were $D(60) =.14$, $p < .005$, and $D(60) =.15$, $p < .005$ for numerical ability. Next, we talked about homogeneity. The statistical results indicate that $F(1, 58) = 0.05$, $p > .05$, and the distribution is homogeneous.

Table 5

Differences between boys' and girls' performance on the numerical test

Groups	*n*	*M*	*SD*	*F*	*t*	*t*(60)	*p*
Boys	27	81.48	5.87	0.74	.39	-.70	.005
Girls	33	82.52	5.54				

The differences in the student's abilities

The regression test is satisfied if the covariate and dependent variables have a linear relationship. The results of multiple regression for the analysis are shown in Table 6.

Table 6

Results of multiple regression analysis for a numerical score as a dependent variable

Independent variables	*r*	*ß*	*r·ß*·100	*p*
Learning Creativity	.85	.76	64.48	<.001
Ethnic	.12	.12	1.39	.09
Treatment	-.56	-.15	28.08	.06
Living Place	-.29	-.09	2.64	.19
Total variance explained			76.60	

Table 6 shows the percentage of variance explained by the independent variables included in the analysis. The results indicate that the independent variables account for 76.60% of the variance in the dependent variable. The total variance explained is 76.6% if we consider only the independent variables that contributed significantly to the regression model, $R^2 = .76$, $p < .001$. That can be expected of the numerical test seems to exert the strongest influence, on the other hand, may have an impact on the developmental level of learning creativity. It is also influenced by ethnic students' which task characteristics may explain. Regarding the treatment class (i.e., experiment and control), high explained variance was found by the grade-point average, which indicates that the numerical test influences. Regarding the analysis of coefficients, the learning creativity test score ($t = 9.83$, $p < .001$), is the significant explanatory variable. However, ethnic ($t = 1.72$, $p > .001$), treatment class ($t = -1.88$, $p > .001$), and living place ($t = -1.31$, $p > .001$) does not contribute significantly to the regression model. In the case of learning creativity, the value of the standardised regression coefficients ($ß = .88$) is the highest. The regression model containing all independent variables significantly predicts the dependent variable, F (59) = 45.01, $p < .001$.

Anova was utilised to alter the value of the dependent variable by removing the treatment effect (Yanah et al., 2018). Eliminating treatment impact bias aims to reduce error variance by controlling for the hypothesised impacts of covariate variables on the analytic results. Statistical covariance analysis can be used to protect groups from the influence of variables other than treatment variables (Hair et al., 1995). Here are the outcomes of the one-way Anova test.

Table 7 illustrates the Anova results. The statistical results for the model (X_1) indicate that $F(1, 59) = 4.65$, $p < 0.05$, indicating that the B learning model has influence on the numerical skills of the students. In the covariate category (X_2), $F(1, 59) = 97.95$, $p < 0.001$, indicating that the

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covariate variable of learning creativity had an effect on the numerical skills of the students. On the other hand, $F(2, 59) = 84.55$, $p < 0.001$, indicating that the B learning model and learning creativity simultaneously influence the numerical skills of the students. Here is an example of the students' answers in the experiment and control class.

Table 7
The results of One-Way Anova

Source	Type III Sum of Squares	df	Mean square	F	Sig.
Correction Model	1987.688[a]	2	993.84	84.55	.000
Intercept	.46	1	.463	.04	.843
X_2 (covariate)	1151.42	1	1151.42	97.95	.000
X_1 (model)	54.73	1	54.73	4.65	.035
Error	670.05	57	11.76		
Total	349826.00	60			
Corrected Total	2657.73	59			

a. R Squared = .748 (Adjusted R Squared = .739)

Table 8 presents the results of a Scheffe analysis examining parameter differences. The Scheffe analysis results revealed significant differences among the examined variables. While the intercept was not statistically significant ($B = 0.39$, $p = .96$), indicating no baseline effect, the second parameter demonstrated a strong and highly significant relationship ($B = 0.91$, $p < .001$) with narrow confidence intervals [0.73, 1.09], suggesting a reliable and robust effect. The third parameter also showed a significant moderate effect ($B = 2.23$, $p = .04$) with broader confidence intervals [0.16, 4.29], while the fourth parameter served as a reference category in the analysis.

Table 8
Scheffe analysis

Parameter	B	Std. Error	t	Sig.	95% confidence interval	
					Lower bound	Upper bound
Intercept	.39	7.29	.05	.96	-14.23	14.99
$X2$	.91	.09	9.89	.00	.73	1.09
$[X1 = 1{,}00]$	2.23	1.03	2.16	.04	.16	4.29
$[X1 = 2{,}00]$	0[a]	.	.	.	.	.

Figure 7 illustrates the responses of students from both the experimental and control classes. Although each class consists of 30 students, this report presents one example from each group.

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Figure 7

Students answer in experiment class (a) and control class (b).

(a)	**In English** a. What is the area of a "Tapis kaca" square with dimensions of 10 cm x 10 cm, if a frame with a width of 2 cm is added around the outside of those dimensions? b. The width of the gold-coloured part. c. Rectangle formula = length x width. Area = 1444 cm²
(b)	a. Determine the area of the square. b. The area of the shaded side is 2 cm. c. Area = 2^2 (2 x 2 cm)

5. Discussion

The results of the one-way Ancova test indicate that the B-learning model influences numerical aptitude. This is demonstrated by the fact that students taught with the B learning model scored higher on the posttest for arithmetic ability than students taught with the standard model, particularly on measures of understanding in recognising numerical patterns and their links. This is because the B-learning paradigm offers numerous benefits. The benefits of mixed learning include the following. Students can exercise their creativity and numeracy abilities with the aid of online materials, communicate with teachers and other students outside of the classroom, and monitor students' learning activities in the classroom. The teacher can supplement face-to-face sessions with Internet-based learning tools, such as videos or PowerPoint presentations.

In the classroom, we have implemented the B-learning model in three stages. The first stage is the search for information, which involves searching for information from various sources on the Internet, in books, and elsewhere, as well as making critical selections among the information sources based on their relevance, validity/reliability, and academic clarity. The teacher acts as a subject matter expert who can provide feedback and advise using information and communication technologies. The second stage is the acquisition of information. Individually and in groups, students must be able to locate, comprehend, and apply preexisting ideas or conceptions, then analyse information or knowledge from many available sources until they can convey and interpret those concepts. The third stage of knowledge synthesis is the reconstruction or formulation of knowledge through an assimilation and accommodation procedure, beginning with the outcomes of analysis, discussion, and the formulation of conclusions from the information gained (Maya, 2020; Winanti, 2022).

Before instruction begins, a teacher may assign students reading or completing the questions. The instructor can administer quizzes, provide feedback, and utilise the results of the tests.

Students can also share files with classmates (Taghizadeh & Hajhosseini, 2021). Similarly, the learning inventiveness of the students influences their numerical skills. Students with a high level of learning creativity are likely to have excellent abilities, whereas students with a low level of learning creativity have poor arithmetic skills. This is evident from the post-test results on numerical ability, which show that students with high learning creativity are more likely to correctly answer questions on questions on questions on questions on numerical ability, particularly in the indicator of problem solving ability, as learning creativity is closely related to numerical ability. Consequently, the B-learning model and learning creativity simultaneously impact students' numerical abilities.

B-learning is a type of instructional design that combines traditional classroom teaching with online learning activities. In a blended learning model, students participate in both face-to-face instruction and online learning experiences, which are typically delivered through a learning management system (LMS). The specific design of a blended learning model can vary, but it typically includes a mix of synchronous (live) and asynchronous (self-paced) learning activities. For example, students can attend in-person lectures or discussions, participate in online discussion forums, complete quizzes or assignments online, or watch recorded lectures or instructional videos.

B-learning models can offer several benefits over traditional classroom instruction or fully online learning. For example, they can provide greater flexibility for students, who can complete some learning activities on their own schedule. B-learning can also offer opportunities for more personalised learning experiences, as students can access materials and resources that are tailored to their individual needs and interests. Finally, B-learning models can help improve student engagement and motivation, as they provide a variety of learning activities and opportunities for interaction with peers and instructors.

Based on the implemented that we have been provided, the experiment class used the B-learning model, while the control class received schooling that followed the Indonesian K-13 curriculum. To determine the effectiveness of the B-learning model, researchers probably conducted statistical analyses comparing the performance of the the students in the experiment class (using B-learning) with those of the control class (using traditional instruction). The results of these analyses would provide information on whether the B learning model led to better academic outcomes (in terms of numerical ability) than traditional instruction.

In this situation, it would appear that the B-learning model was successful in improving student performance in the experimental class. This could be due to a variety of factors, such as the increased flexibility and personalised learning opportunities that B-learning provides, or the use of multimedia resources and other digital tools that can enhance the learning experience.

However, it is important to note that the effectiveness of the B-learning model can depend on a variety of factors, including the specific design and implementation of the model, the content being taught and the characteristics of the students and teachers involved. Therefore, while the results of this study suggest that B learning was effective in this particular context, it may not necessarily be effective in all contexts.

The differences in the model in both classes can be detected in the questions. Figure 4 indicates that the numerical question is difficult for most students, while the numerical5 is easy. However, many students are unable to answer easy questions. This is because students have many characteristics and come from different cities. Additionally, the time of learning is quite different. Alternatively, students may be required to withdraw from the competition because they lack the skills or achievements to justify the questions (Mata-Pereira & da Ponte, 2017).

Table 8 is a post-Ancova to determine whether the factor influences the numerical skills of the students in relation to the B-learning model and learning creativity. After controlling for the inventiveness of the students, the value of $t(1,59) = 2.16$, $p < 0.05$, indicating that the numerical ability of students who receive the B learning model is superior to that of students who receive the conventional model. Due to the fact that the B-learning model is a combination of offline and online learning, it is ideal for students with kinaesthetic, visual and auditory learning styles (Hu et al., 2021; Suryati & Adnyana, 2020). Furthermore, the B-learning paradigm improves the learning process because it allows both face-to-face and online learning. In this online learning approach, students are encouraged to be more creative and independent to develop their numerical skills (Suherman & Vidákovich, 2024; Supriadi et al., 2024). Furthermore, online learning is accessible at any time and from any location, making it easier for students to study course material (Sari & Wahyudin, 2019; Zhu et al., 2022). In accordance with this assertion, a study (Ulfa & Puspaningtyas, 2020) discovered that the B-learning model is more successful in improving the comprehension of mathematical concepts because it integrates face-to-face and online learning. This is consistent with the findings of (Sudiarta & Widana, 2019), who discovered that the B learning model was more effective than the traditional approach in enhancing students' arithmetic skills. According to the explanation above, the B-learning model is superior to the conventional model.

6. Conclusion

The study findings indicate that the B-learning model affects students' numerical skills by regulating their learning creativity. This indicates that the integrated learning strategy is more appropriate for enhancing students' numerical skills. In addition to the B-learning model, creative learning also affects numerical skills. Lastly, the B-learning model and creativity influence the numerical aptitude simultaneously.

While numerical ability is a crucial talent in mathematics and its development is essential, this study appears to be primarily concerned with numerical skill. Furthermore, the sample size is limited and only high school students are included. This implies that learning models and learning creativity are crucial for mathematics education research and must be taken into account during the learning process, particularly when training students' numerical skills. The B-learning approach can be used as a solution for students' autonomous learning through online learning to develop their numerical abilities and creativity. Additionally, the B-learning approach is adaptable to all contexts, scenarios, and student learning styles. To apply the B-learning model in the teaching and learning process, future research should be able to consider aspects other than affective factors. These findings encourage educators to consider B-learning not only as a content delivery method but as a way to develop students' creative thinking and problem-solving skills, which are critical in today's increasingly digital and complex world.

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