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The impact of a gender mainstreaming-based blended learning flipped classroom model on the solidarity values and problem-solving abilities of students

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Abstract

This study examines the impact of a gender mainstreaming-based blended learning flipped classroom model on the solidarity values and problem-solving abilities of students. The acquisition of problem-solving skills and the cultivation of values related to solidarity are imperative proficiencies in the context of 21st-century dynamics. These competencies serve as pivotal attributes for students aspiring to navigate the intricacies of communal and national challenges. An existing quandary lies in the domain of primary education within the Aceh province, and the pedagogical landscape within primary schools has not incorporated the essential dimension of nurturing adeptness in problem-solving. This is because learning is still teacher-centered and needs more student engagement. Therefore, a model should be developed to address the issue of gender mainstreaming-based blended learning in a flipped classroom model. This research aims to develop a model for developing a blended learning flipped class based on gender mainstreaming to increase students' solidarity values and problem-solving abilities. This study employed a development model that referred to the 4-D model proposed by S. Thiagarajan et al., consisting of definition, design, development, and dissemination. The sample consisted of fifth-grade elementary school students from SD Negeri Kajhu, Aceh Besar Regency, who were taught using the gender mainstreaming-based blended learning flipped classroom model. The results showed that the developed learning model created more meaningful learning experiences. Solidarity values and problem-solving abilities of students increased when taught with the learning model.

Keywords: Blended learning, Elementary education, Flipped classroom, Gender mainstreaming, Problem-solving, Solidarity values.

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1. Introduction

The use of Information and Communication Technology (ICT) is becoming more widespread in different fields, specifically in the field of education [1-3]. ICT in education can have a positive impact on the quality of education and can facilitate teachers in conducting in-person and remote learning [4, 5]. Furthermore, it stimulates the minds, feelings, interests, and attention of students to enable an effective learning process [6]. The use of ICT as a learning medium involves the utilization of computer devices as innovative media [7]. The learning process is rendered significantly more efficacious through the utilization of ICT as an educational medium. This approach facilitates the surmounting of various impediments in communication between teachers and students, such as physiological, psychological, cultural, and environmental factors.

The 21st-century skills demand learners possess several abilities, including problem-solving categorized within learning and innovation [8-10]. These skills enable students to attain added value, flourish in a collaborative work environment, and adapt to community life [11]. Additionally, solidarity, which involves respecting every difference, is a crucial character trait to create a supportive and harmonious learning atmosphere [12, 13].

The learning environment in elementary schools in the Aceh province, specifically in Aceh Besar Regency, shows a predominantly passive learning atmosphere. Learning is teacher-centered, and teachers continue to use regular textbooks [14, 15] while struggling to design contextual learning experiences.

Previous studies show that problem-solving abilities in learning are very low. Students cannot solve problems provided by the teacher and are only capable of solving tasks at the Low-Order Thinking Skills (LOTS) level while struggling with problems based on Higher-Order Thinking Skills (HOTS) [16, 17]. Problem-solving ability is the capacity to discover new combinations of several rules applied to address new situations or unify multiple elements.

The low problem-solving ability is likely due to the teacher-centered learning process and lack of student engagement. Preliminary studies indicate that schools are still conducting teacher-centered learning with conventional approaches or models that involve students less in the learning process [18-20].

The application of a blended learning flipped classroom model rooted in gender mainstreaming is anticipated to offer a resolution for enhancing the proficiencies in problem-solving. This model also harmonizes with the contemporary paradigm of 21st-century education, which leverages ICT. The Flipped Classroom paradigm involves the interchange of conventional in-class tasks, such as teacher-led presentations, with activities conducted beyond the classroom setting, such as homework assignments. The integration of mobile phone technology is employed to facilitate the consumption of instructional videos beyond the classroom. Subsequently, interactive learning through deliberations and exchanges of ideas is orchestrated within the classroom environment or as an integral part of learning. The use of mobile phones is one of the technological aspects of learning and is a characteristic of 21st-century education [21-23].

The application of a blended learning flipped classroom model based on gender mainstreaming in classroom learning is expected to improve problem-solving skills and increase a sense of solidarity between students [24-26]. On the issues, this study was conducted to understand 21st-century problem-solving abilities through the gender mainstreaming-based blended learning flipped classroom model.

2. Literature Review

Flipped learning is a contemporary educational concept that integrates traditional face-to-face classroom instruction with online learning components. Flipped learning entails the transfer of traditional in-class activities, such as the dissemination of instructional content, assignment provision, exercise facilitation, and homework allocation, to the online learning environment.

E-learning is a significant advancement in the field of education that leverages digital technology. This blended learning approach aims to introduce innovation and shift the prevailing learning paradigm [27].

Flipped learning is a prominent form of blended learning in the field of educational research. The individual credited with pioneering the concept of flipped learning was a chemistry educator hailing from Colorado in the year 2007 [28]. Frequently, chemistry students are unable to participate in classroom learning due to their participation in competitions,andothersimilarevents. To prepare for this, the two instructors created videos to document lessons, demonstrations, and presentation slides. These audio files are uploaded to YouTube so that students may obtain them at any time and from any location. Then, in 2012, the Flipped Learning Network (FLN), a nonprofit organisation whose mission is to equip educators with the knowledge, skills, and resources necessary to implement flipped learning, was founded [29].

Blended *Learning Flipped classroom* learning model will contain all components of the learning, model that contain gender mainstreamingvalues, which will later have an instructional impact on students through the syntax of the learning model integrated through an online system. Students will be guided and trained to learn science materials integrated with gender mainstreaming values.

Blended *learning flipped classroom* learning has been popular in developed countries. Many research results state the effectiveness of this learning model in improving student learning outcomes [21, 22, 30]. In addition to improving learning outcomes, this *flipped classroom* learning model effectively improves positive character in students. This is because this learning model allows children (students) to use *online* media to learn, not just to play games [31-33].

The widespread accessibility of the internet and computer applications has facilitated a trend where educational institutions have shown a greater commitment to leveraging computer technology to enhance the learning experience over the past two decades. Like every instructional tool, computer technology offers a variety of ways for its use [34, 35]. One such approach is leveraging technology to expose students to educational experiences beyond the confines of the traditional

classroom setting, enabling them to enhance their cognitive capabilities to the fullest extent inside the classroom environment [36].

Implementing this *flipped* learning approach can potentially train students to be more confident in learning and become independent learners. In addition, teachers who use this approach will also have more time to interact with each student during each class hour and provide them with feedback, either directly or *online*, using various social media or *Learning Management Systems (LMS)* such as *Moodle* [28].

The flipped classroom is also effective in stimulating students' creative thinking skills, especially fluency, *flexibility* and novelty. A *flipped classroom* approach that uses student visualization, especially in videos and presentations, can strongly support creative thinking. In addition to some of the advantages above, the results of applying the *Flipped* classroom approach also foster satisfaction, classroom engagement, student motivation, increasing knowledge, improving critical thinking skills, feeling more confident, and others [37].

Learning in *a flipped classroom is highly recommended in the digital age of 4.0; this online-based learning model can be used for distance learning. Through this* flipped classroom, student activities will be well controlled by teachers and even parents because it is feared that student activities as young people in puberty will be contaminated by bad ideas pervasive in society.

3. Method

This study used a development model that was based on 4-D model that S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel proposed. According to Thiagarajan et al., this model consisted of four steps, namely definition, design, development, and dissemination [38],and was conducted at SD Negeri Kajhu, Aceh Besar Regency, in the fifth grade during the first semester of 2021/2022. This extended duration was necessary due to the use of the blended learning flipped classroom model, which requires a relatively longer time.

The sample was comprised of fifth-grade students from SD Negeri Kajhu, Aceh Besar Regency, who were instructed using a gender mainstreaming-based blended learning flipped classroom model. Two students with high ability, two with moderate ability, and two with low ability were grouped together. Because there were specific considerations and criteria for subject selection, the technique of purposive sampling was employed. The class teacher's recommendations served as the basis for the choice, and the students' most recent daily test results served as the indicator of their aptitude level.

This development procedure aligned with the steps of the 4-D development model. The activities commenced with curriculum analysis, followed by learning material design, and preceded through the steps of developing the learning tools, as depicted in the Figure 1:

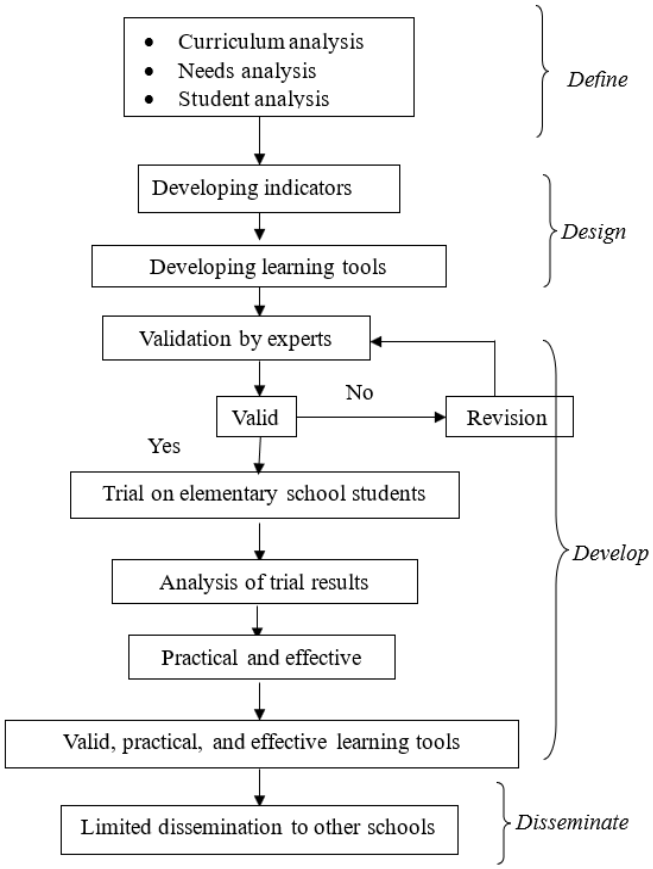

Figure 1. Learning model development design.

The defined stage of the process seeks to ascertain and establish the requisite circumstances for the development of learning models. This phase involves the analysis of the objectives within the defined scope of the subject matter that has been produced. At this stage, the tools employed include observation sheets and a set of interview questions. The process encompasses three distinct steps, namely curriculum analysis, needs analysis, and student characteristics analysis.

The design stage of the researcher Compile a learning model design that is prepared based on the demands of the applicable curriculum.

Development Stage: This stage aims to produce a valid, practical, and effective learning model.

Dissemination Phase At this deployment stage, the subsequent trial will be carried out on a limited scale against the revised learning model based on previous trials. At this stage, an evaluation is carried out on whether the learning model can be used to achieve practical goals by improving the quality and achievement of student learning. The learning model is effective if it can provide good results for the development of character values and reading skills in students.

The data collection methods used included observation sheets, tests, peer assessment, interviews, and a validation sheet for the learning model that expert teams would evaluate.

The assessment tools employed in this study comprised pre-tests and post-tests. These instruments were utilised to evaluate the efficacy and progress of the model by examining the level of improvement in student learning outcomes prior to and following the completion of classroom teaching. The assessment of learning outcomes was conducted using open-ended questions, and a pilot test of the assessment was administered to students who were not included in the sample.

Test instruments in the form of pre-tests and post-tests are used to assess the improvement and effectiveness of the model through the quality of student learning outcomes at the beginning and after completion of learning carried out during meetings in the Learning Implementation Plan (LIP). Learning outcomes tests take the form of descriptions. Once validated, learning outcomes tests are tested on students who are not samples in the study. Test trials aim to obtain valid and reliable tests. Test trials use validity, reliability, difficulty, and differentiation power tests.

The employed methodology involves descriptive data analysis, which assesses the validity and practicality of the learning model, as well as the competence of the students, hence indicating the efficacy of the learning model.

The validity of the learning model was assessed by employing a Likert scale methodology, which was based on the utilisation of validation sheets. The scoring for each category is presented in the subsequent Table 1.

Table 1.
Scoring learning model validity.

Score	Category	Indicator achievement percentage
1	Not good	0-25
2	Good enough	26-50
3	Good	51-75
4	Excellent	76-100

The quality of the feasibility of developing the developed device is seen from the assessment of the expert team validators on the developed device. The formula used in this study is as follows:

$$\text{Va} = \frac{R}{N}$$

Information:

Va : Total average value for all aspects.
R : Total value obtained from all aspects.
N : Many aspects.

The validity category of the learning model based on the final grade obtained can be seen in the following Table 2:

Table 2.
Learning model validity categories.

Interval	Category
1.00-1.99	Invalid
2.00-2.99	Less valid
3.00-3.49	Valid
3.50-4.00	Highly valid

Furthermore, conducting an inferential statistical analysis is crucial for determining the effects of the developed learning model. The present study utilized a combination of descriptive analysis, a requirements analysis test, and a hypothesis test for data analysis. Descriptive statistics are utilized to provide a characterization of the data associated with the variables under investigation. To get a full picture of the research variables, frequency distributions and histogram graphs will be made using the descriptive statistics of the mean score, median score, mode standard deviation, and variance for each variable. To determine the patterns demonstrated by each variable in prior research, the normal curve was constructed using the mean ideal score (Mi) and ideal standard deviation (iSD) of each variable.

In order to ensure accurate conclusions, it is necessary to satisfy several analytical requirements. These requirements include: (1) employing a random sampling method for selecting the study's sample; (2) ensuring that the data distribution of both exogenous and endogenous variables in the model follows a consistent pattern; and (3) measuring variables without any errors.

4. Study and Analysis

4.1. Description of Development Results

The developed learning model involves the gender mainstreaming-based blended learning flipped classroom model. Several supporting components are part of this learning model, including (i) Lesson Plan (LP) validity, (ii) module validity, and (iii) test instrument validity. The development is carried out through (a) validation by experts and (b) the piloting of learning materials and study instruments. This process involves identifying learning objectives, analyzing the process, identifying learner characteristics, outlining work objectives, developing tests, designing strategies, selecting appropriate materials, revising activities, and constructing evaluation tools.

4.1.1. Initial Development Planning

After examining cognitive development, the fifth-grade students at SD Negeri Kajhu were reported to require concrete objects in the learning process. For instance, images depicting an organization gathering were used to illustrate deliberation and elements related to daily experiences. Therefore, it was highly suitable to commence the learning process with contextual problems closely related to everyday life.

Studentswerecapableoffollowing along with the teachers' instructions. However, due to the lack of learning variety in the approach, this was one of the factors contributing to the low level of learning outcomes. The outcomes have consistently been low and fell below the Minimum Passing Grade (MPG). Specifically, there were still students who scored below the minimum passing grade of 75, with 14 out of 36 who took the test achieving the minimum score. This resulted in a learning outcome of 44.44%below the total number of students who took the test and failed to meet the Minimum Passing Grade (MPG).

4.1.2. Developing Learning Materials in the Module

The first step before arranging other components within the learning materials was to formulate guidelines. The content of the usage guidelines entailed explaining the step-by-step process of conducting learning activities. The specific design of the guidelines included instructions for using the concept, outlining the steps in the learning process, and indicating the steps at the beginning and end. After constructing usage guidelines for interactive learning, the subsequent step was to formulate learning objectives, including competency standards and basic competencies.

4.1.3. Validation Step

4.1.3.1. Validation Results from the Learning Model Expert on Language Aspect

The validator evaluates the structure, language, and content of the lesson plan. By adhering to the validator's recommendations and instructions, revisions take the discussion outcomes into account. The analysis of data for language assessment and feedback is depicted in Table 3:

Table 3.
Validation results and feedback for language expert.

Assessment aspect	Assessment indicators	Alternative assessment			
		1	2	3	4
Language usage aspect	1. Sentence structure accuracy			√	
	2. Sentence effectiveness			√	
	3. Clarity of language in content			√	
	4. Sentence clarity				√
	5. Attractiveness of language style			√	
	6. Proper and correct use of Indonesian language rules			√	
Language accuracy aspect	7. Clarity of letters				√
	8. Used symbols				√
	9. Clarity of command/Instruction words			√	
	10. Use of simple, clear, and easily understood language			√	
	11. Use of improved spelling standard spelling			√	
Student development suitability aspect	12. Language tailored to student developmental step			√	
	13. The language that stimulates students' imagination			√	
	14. Language easily understood by students			√	
Total				33	12
Average		45 x 100/14 = 321.4			

From Table 3, the average scores for each assessment aspect from the Language Expert's Assessment and Feedback indicate values greater than or equal to 3.214 (≥ 3.0) under the "valid" category. The average score falls above four, categorized as "valid,"henceassessmentand feedbackcan be used with minor revisions.

4.1.3.2. Validation Results from the Learning Model Expert on Design Aspect

The validator's evaluationof the course execution plan takes into account its structure, linguistic components, and

content. The ideas and guidance of the validator were followed in considering the discussion outcomes during the revision process. The data analysis pertaining to design assessment and feedback is presented in the subsequent sections. Table 4 presents the relevant data:

Table 4.
Validation results and feedback for design expert.

Assessment aspect	Assessment indicators	Assessment items	Alternative assessment			
			1	2	3	4
Presentation suitability	Presentation techniques	1. Consistency of presentation system in learning activities			√	
		2. Conceptual coherence				√
	Supporting presentation	3. Examples of questions in learning activities			√	
		4. Question practice at the end of the learning				√
		5. Accuracy of image selection			√	
		6. Accuracy of color selection in images		√		
		7. Accuracy of story selection				√
		8. Introduction				√
Presentation	Learning presentation	9. Student involvement in learning activities				√
		10. Encouraging students to answer in their own ways				√
Language use	Coherence and logical flow	11. Connection between learning activities				√
		12. Presentation timing				√
		13. Language comprehension ease			√	
Image selection	Appearance quality	14. Appearance			√	
		15. Illustrations			√	
Total				2	18	32
Average			52/15 = 3.47			

According to the data presented in Table 4, the average scores for each assessment element in the Assessment and Feedback category are equal to or more than 3.47 (≥ 3.0) in the "valid" category. The mean score for the Assessment and Feedback exceeds four, indicating its validity and potential for utilization with minimal modifications.

4.1.3.3. Validation Results from the Learning Model Expert on Content Aspect

The validator evaluates the lesson implementation plan's format, language, and content. By adhering to the validator's recommendations and instructions, revisions took the discussion results into account

Data analysis for Content Assessment and Feedback is presented in the following Table5:

Table 5.
Validation results and feedback for content expert.

Assessment aspect	Assessment indicators	Assessment items	Alternative assessment			
			1	2	3	4
Content suitability	Quality of learning material	1. Clarity of learning objectives				√
		2. Accuracy of content coverage			√	
	Learning delivery system	3. Correctness of concepts				√
		4. Alignment with the curriculum				√
		5. Compatibility with an open-ended approach				√
		6. Appropriateness of the sequence of learning content			√	
		7. Depth of learning content			√	
Content presentation	Quality of learning strategy	8. Quality of Introduction				√
		9. Student engagement and role in learning activities				√
		10. Encouraging students to answer in their own ways				√
		11. Quality of feedback				√
		12. Presentation timing				√
		13. Quality of practice questions			√	
Language use	Quality of learning material	14. Comprehensibility of material and logical presentation				√
		15. Language comprehension ease				√
Image selection	Quality of appearance	16. Appearance			√	
		17. Illustrations			√	
Total					18	44
Average			62/17 = 3.65			

According to the data presented in Table 5, the average scores for each assessment aspect in the Assessment and Feedback category are equal to or greater than 3.65 (≥ 3.0) in the "valid" classification. The mean score for the Assessment and Feedback is above four, indicating its validity and potential for use with minimal modifications.

4.1.3.4. Assessment and Feedback from Learning Model Experts

The assessment by the validator covers Model Rationale, Supporting Theories, Model Content, Syntax, Social System, Reaction Principles, Support System, and Objectives/Impact. In making revisions, the discussion outcomes were considered by following the suggestions and guidance of the validator.

Data analysis of the validation results for the Assessment and Feedback from Learning Model Experts is presented in the following Table6:

Table 6.
Validation results and feedback for model expert.

Assessment aspect	Assessment indicators	Assessment items	Alternative assessment			
			1	2	3	4
Model rationale	Learning paradigm	1. Learning objectives provided are capable of illustrating the required competencies in learning.				√
		2. Alignment with the demands of the 2013 curriculum.			√	
		3. The rationality of model development is relevant to the model.				√
	Foundation of the learning model	4. Possesses a foundation for model development.				√
		5. Has philosophical, psychological, and practical foundations in model development.			√	
Supporting theories	Understanding of cognitivism and constructivism	6. The presented developmental theory is substantial as a basis for formulating the learning model.			√	
		7. Relevant character concepts as the foundation of the learning model.				√
		8. Cognitivist and Constructivist theories related to the process of creative character, hard work, and curiosity are relevant to support the learning model.				√
Model content	Model structure	9. General presentation organization.				√
		10. Attractive overall appearance.				√
		11. Consistent connection between language elements.				√
	Organization of model writing	12. Content coverage.				√
		13. Clarity and sequence of content.			√	
		14. Consistency between problems and students' life context/Cognition contained in the model book.				√
		15. Evaluation and assessment are clearly stated.				√
	Presentation	16. Presentation techniques.			√	
		17. Coherence and logical flow of thought.				√
Syntax	Syntax in learning activities	18. Clear learning steps.			√	
		19. High level of syntactic implementation.			√	
		20. Syntactic phases depict principles of active and enjoyable learning.				√
		21. Syntactic phases include concrete steps in conducting learning that can shape students' character.				√
		22. Syntactic phases include simple and easily achievable steps.				√
Syntax	Visible social interaction	23. Clear student collaboration is evident.				√
		24. Interaction between teacher and students occurs.				√
		25. Interaction between students takes place.				√
Reaction principles	Reactions during activities	26. Active student engagement is apparent.			√	
		27. Students appear more adept at problem-solving from the given discussion materials.			√	
		28. The role of the teacher as a facilitator is evident.			√	
		29. The role of the teacher as a guide is evident.			√	
		30. The role of the teacher as an evaluator is evident.				√
Support system	Supporting materials and facilities	31. The classroom environment is very comfortable for learning.				√
		32. Comprehensive guidebooks are available.				√
		33. Supporting learning materials.				√
		34. Classroom atmosphere and school environment.				√
		35. Facilities supporting learning activities.				√
Impact	Direct and indirect impact	36. Meaningfulness of student experiences in learning.			√	
		37. Improvement in learning outcomes.			√	
		38. Ability to shape student character.				√
		39. Enhancement of students' problem-solving skills in school and their environment.				√
		40. Enhancement of students' social interaction skills.				√
Total					39	108
Average					147/40 = 3.675	

According to the data presented in Table 6, the average scores for each assessment element in the Assessment and Feedback for Model Experts exhibit values that are equal to or greater than 3.675 (≥ 3.0) inside the "valid" category. The mean scores aresituatedwithin a rangegreater than four, according to the "valid" requirements, and can be utilizedwithlittlemodification.

From Tables3, 4, 5, and 6, the assessments and Feedback for Language Experts show scores greater than or equal to 3.214 (≥ 3.0) in the "valid" category. Moreover, the assessments indicate scores greater than or equal to 3.47, 3.65, and 3.675 (≥ 3.0) in the "valid" category. The distribution of scores from students can be represented in a histogram as a statistical data diagram, as shown in Figure 2:

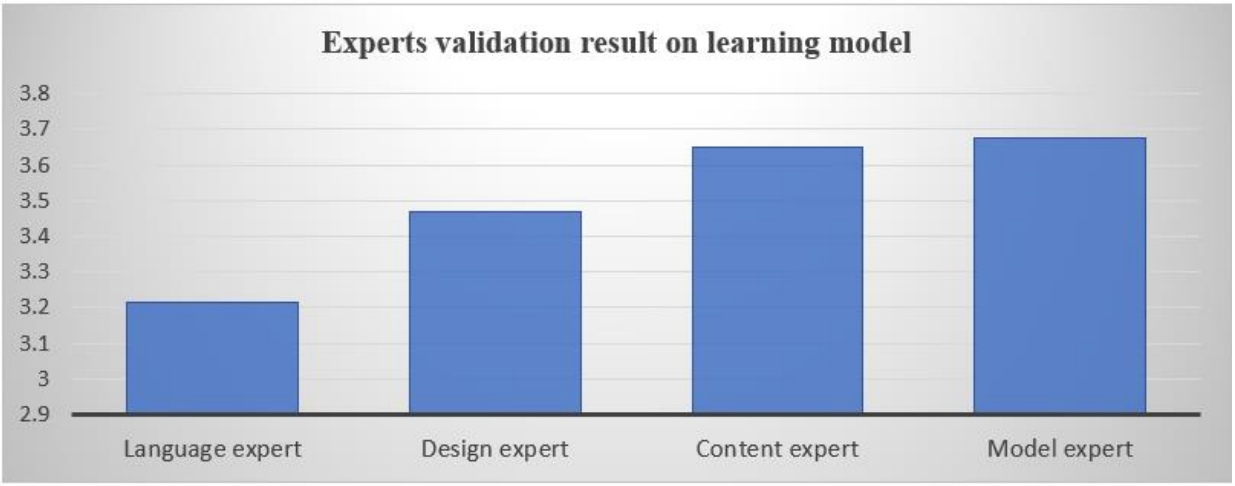

Figure 2.
Assessment and feedback from model learning design experts.

4.1.3.5. Results of Learning Material Validation

Lesson planning is a follow-up to the revision of test instruments and materials such as Lesson Plan (LP), student textbooks, and teacher guidebooks. Validation by experts is conducted to assess the validity of learning materials, including the content and language.The results of the validator assessment are as follows:

1. The assessment aspect of the learning plan validation results gives a value greater than or equal to 4.40 (≥ 3.0) withthecategory "valid."So, itcan be concluded that Assessments and Responses for Experts can be used with minor revisions.
2. The assessment aspect of student book validation results gives a score greater than or equal to 4.03 (≥ 3.0) withthecategory "valid."So, itcan be concluded that Assessments and Responses for Experts can be used with minor revisions.
3. The assessment aspect of the validation results of the teacher manual gives a score greater than or equal to 3.94 (≥ 3.0) withthecategory "valid."So, itcan be concluded that Assessments and Responses for Experts can be used with minor revisions.
4. The assessment aspect of the validation results of the learning management observation sheet gives a value greater than or equal to 3.98 (≥ 3.0) with the category "valid". So, it can be concluded that Assessments and Responses for Experts can be used with minor revisions.

The results for the student character questionnaire aspect yield a score greater than or equal to 3.95 (≥ 3.0) with the category "valid." Therefore, the Assessment and Feedback from Experts can be used with minor revisions.

The assessmentaspectof the student learning outcome test provides a score greater than or equal to 4.09 (≥ 3.0) with the category "valid." Consequently, the Assessment and Feedback from Experts can be used with minor revisions.

Based on the validation calculation results, the instruments fall within the valid category and are suitable for field testing in the study phase, as depicted in the diagram below.

4.1.4. Trial Results

Model trials and learning tools were carried out with a large number of test subjects, 36 students in class V at SD Negeri Kajhu, Aceh Besar Regency, who were taught using learning models and teaching materials developed under the lesson plans. Figure 3 Ilustrate Assessments and feedback on Learning material.

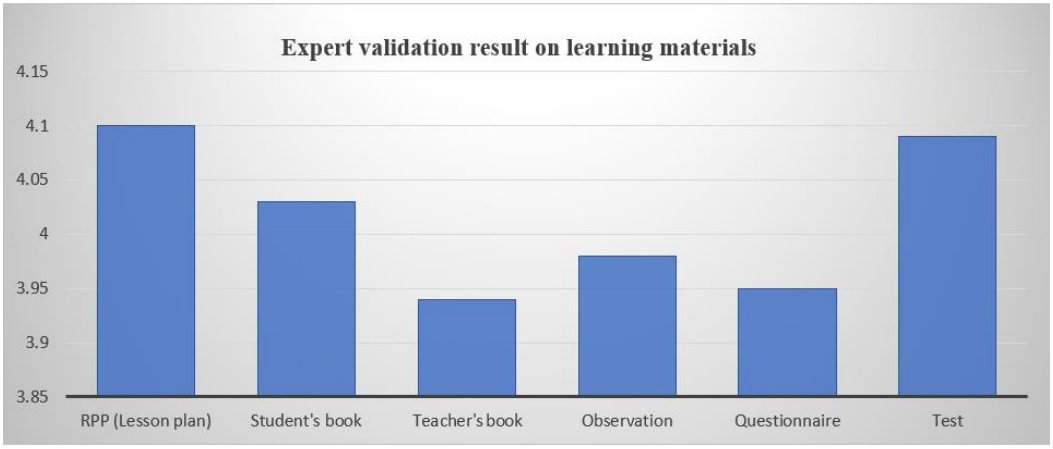

Figure 3. Assessments and feedback to Learning material.

4.1.4.1. Observation Results of Teachers' Ability to Manage Learning

The observationsheetthatobservers use to manage learning serve as a measure of their ability to manage learning usingthetoolsprovided.The teacher did fairly well in preparing students to learn, guiding individual and group investigations, analyzing and evaluating problem-solving, and concluding the lesson. In addition, the instructor received high marks for introducing the lesson, orienting students to problems, and developing and presenting work. Observations of the capacity to regulate learning were conducted throughout the learning process, and the outcomes arepresented in Table 7.

Table 7.
Teacher's ability to manage learning during product trials.

Observed aspects	1	2	3	4	5
Phase-1 classifying and determining fundamental questions					
a. Inform goals, basic competencies, and learning indicators.					√
b. Motivating students about the use and application of lessons in everyday fields.				√	
c. Direct students to questions or problems.					√
d. Ask students to ask questions.				√	
e. Exploring the extent of students' knowledge of the prerequisite material.				√	
Phase-2 develop planning and information					
f. Inform learning methods and deficiencies in previous learning.			√		
g. Conveying problems in learning.					√
h. Dividing/Preparing teaching materials/Modules.					√
i. Determine the distribution of groups.					√
j. Form a group of experts and facilitate it.					√
k. Direct students to examine the module.					√
l. Encourage discussion dialogue with friends.				√	
Phase-3 monitoring and assisting teamwork					
a. Guide students to work on the problems contained in the module.					√
b. Guiding, and observing group work.			√		
c. Prepare various alternative solutions to problems.				√	
d. Helping students define and organize learning tasks related to problems					√
e. Motivate and set an example to emulate.				√	
Phase-4 monitoring and assisting teamwork					
a. Guide students to make ideas according to their own understanding to provide group answers.			√		
b. Motivating students to present the results of their group work.					√
c. Directing each group to provide input and questions to the presentation group hence students can apply them.			√		
Phase-5 evaluate and provide recognition					
a. Directing to provide conclusions to groups presenting their group work.			√		
b. Give praise to other groups for suggestions and questions to the presentation group.					√
c. Giving conclusions to all students to make their own conclusions about the day's lesson.				√	

Based on the data presented in Table 7, the scores obtained for instructor activities in the Lesson Plan (LP)remain within the satisfactory range.

During the initial gathering, the students exhibited a high level of engagement by actively participating in the discourse surrounding the presentations delivered by their peers. Moreover, the dimensions of comprehending issues, resolving issues, and deriving conclusions from a concept remained within the adequate range. The participation of students in group work has facilitated their active engagement in problem-solving.

The teachers have become more proficient at adapting, enabling the implementation of the learning process to be carried out effectively. Since the activities for each observation category consistently meet the criteria of excellence, no revisions were made to the learning materials. However, the learning process has not reached the threshold of success, which is the criteria stating teachers are capable of managing the blended learning flipped classroom model with a gender-sensitive approach. The minimum level of learning management competence was considered satisfactory, with $3 \leq NKG < 4$, and a score of 4.4 was achieved.

The average value of the teacher's capacity to manage learning is at the limit of successful learning. The criterion specifies that the teacher must be able to manage learning with a minimum level of proficiency, specifically $3 \leq NKG < 4$. It was determined that the level of skill falls within the very high category.

4.1.4.2. Results of Data Analysis of Problem-Solving Ability

Measuring students' performance on the given exams served as the post-instruction assessment of their problem-solving abilities. The obtained scores showed that the results of the student assessments carried out during the trails demonstrated a high level of proficiency. Out of the total of 36 students, just one did not attain learning mastery.

The score data based on individual completeness criteria showed that students completed learning individually, as seen in Table 8.

Table 8.
Student problem-solving ability in product trials.

No	Average score	Criteria	Total	Percentage (%)
1	$70.00\% \leq KB \leq 100.00\%$	Complete	31	86.11
2	$0\% \leq KB < 69.99\%$	No	5	13.89

Based on the data in Table 8 above, classical completeness has reached 86.11%. So that the ability to solve problems classically is complete.

The conclusions from the results of the trial data analysis are as follows:

1. The ability of teachers to manage learning at each stage meets the criteria of being good. When viewed from the overall average, the level of teacher ability to manage learning is in the good category.
2. Student activities in learning activities are already in the specified category.
3. Thereisanincrease in theabilityto achievesuccessful student learning outcomes.

Suppose the conclusion of the results of data analysis in thistrialreferstothecriteria set. In that case, the application of the developed learning tool product has met the effectiveness criteria.

4.1.4.3. Calculation of the Frequency Distribution of Problem Solving Ability

The results of the study conducted at the end of the experiment showed that for the fourth-grade students, the highest, lowest, and average scores were 40, 23, and 32.42. By using the Sturges technique, a range of 17 was obtained, and the number of class intervals was 7 with the length of 3. The list of frequency distributions regarding student learning outcomes can be seen in Table 9 as follows:

Table 9.
Table of the frequency distribution of problem-solving ability taught using gender mainstreaming-based blended learning flipped classroom model.

No.	Interval class	Absolute frequency	Frequency relative %	Cumulative frequency %
1	23 – 25	3	8.3333	8.333
2	26 – 28	4	11.111	19.440
3	29 – 31	8	22.222	41.670
4	32 – 34	9	25.000	66.670
5	35 – 37	7	19.444	86.110
6	38 – 40	5	13.889	100
Total		36	100	100

From Table 9, the average score is 32.42, where 12 (33.333%) and 9 (25.000%) students obtained scores above the average, while 15 (41.667%) obtained scores below the average.

The results showed that for control class students, the highest, lowest, and average scores were 35, 27, and 23.39. Using the Sturges technique, a range of 27 was obtained, and the number of class intervals was 7, with a length of 4. The list of frequency distributions regarding problem-solving abilities can be seen in Table 10:

Table 10.
List of frequency distribution of students' problem-solving ability taught using conventional learning.

No	Interval class	Absolute frequency	Frequency relative %	Cumulative frequency %
1	8 – 11	4	11.111	11.111
2	12 – 15	4	11.111	22.222
3	16 – 19	4	11.111	33.333
4	20 – 23	8	22.222	55.556
5	24 – 27	8	22.222	77.778
6	28 – 31	4	11.111	88.889
7	32 – 35	4	11.111	100
Total		36	100	100

From Table 10, the average score is 23.39, where 16 (44.444%), 8 (22.222%), and 12 (33.333%) students have a score above, on, and below the average score of the Problem-Solving Ability, respectively.

4.1.4.4. Data Normality Testing for Group Problem Solving Ability Learning Model

To test the normality of learning group data for Problem-Solving Ability taught by gender mainstreaming-based blended learning in a flipped classroom model and that taught by conventional teaching, we conducted a study using SPSS Version 25. The results of calculating data normality are shown in Table 11.

Table 11.
Data normality test results for problem-solving ability of learning models.

One-sample Kolmogorov-Smirnov test			
		Experiment	Control
N		36	36
Normal parameters[a,b]	Mean	32.42	23.39
	Std. deviation	4.481	5.886
Most extreme differences	Absolute	0.069	0.060
	Positive	0.045	0.059
	Negative	-0.069	-0.060
Test statistic		0.069	0.060
Asymp. sig. (2-tailed)		0.200[c,d]	0.200[c,d]

Note: a. Test distribution is normal.
b. Calculated from data.
c. Lilliefors significance correction.
d. This is a lower bound of the true significance.

The results of the normality test for the data on student learning outcomes taught by the learning technique are presented in Table 11. In this table, it can be observed that the groups obtained a value of 0.200 consecutively for the Kolmogorov-Smirnov Normality Test. These groups exhibit a p-value greater than 0.05, indicating that the null hypothesis (H0) is accepted in cases where the data distribution is regularly distributed.

4.1.4.5. Homogeneity Test of Group Variance Learning Model

The summary of the test can be seen in Table 12:

Table 12.
Summary of homogeneity test results for variances between learning model sample group.

Test of homogeneity of variances					
		Levene statistic	Df1	Df2	Sig.
Score	Based on mean	2.033	1	70	0.158
	Based on median	2.031	1	70	0.159
	Based on the median and with adjusted df	2.031	1	63.888	0.159
	Based on trimmed mean	2.033	1	70	0.158

Table 10 shows the learning outcomes of groups of students who are taught using the gender mainstreaming-based blended learning flipped classroom model and conventional learning models. Based on the table above, the statistical significance of the sig test is 0.158. This value is greater than the significant level; hence, H_0, where there is no difference in variance between pairs of groups, is accepted due to a homogeneous variance.

4.1.4.6. Testing Independent T-Test

Before testing the hypothesis, the total and average score of each treatment group was calculated according to the t-test table used as a basis for statistical decisions for hypothesis testing, as seen in Table 13:

Table 13.
Average independent samples test.

Group statistics					
Learning		**N**	**Mean**	**Std. deviation**	**Std. error mean**
Score	Experiment	36	32.42	4.481	0.747
	Control	36	23.39	5.886	0.981

According to the result of the data calculations, students who received instruction using the gender mainstreaming-based blended learning flipped classroom paradigm achieved the average value of 32.42. On the other hand, students who were instructed using traditional learning models achieved an average learning outcome score of 23.39. A t-test was used to see the difference between students who were taught using the gender mainstreaming-based blended learning flipped classroom model and those who were taught using traditional methods. The results are shown in Table 14.

Table 14.
Independent samples test.

Independent samples test										
		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**
Score	Equal variances assumed	2.033	0.158	7.322	70	0.000	9.028	1.233	6.569	11.487
	Equal variances not assumed			7.322	65.369	0.000	9.028	1.233	6.566	11.490

The results of the analysis presented previously are also reflected in the t value for the learning factor, which is 7,322. Consequently, tcount = 7.322, ttable = 2.042, significance level = 0.000, and this value is less than significance level = 0.05. In consequence, H_0 was rejected becausethe Problem-Solving Ability of students taught by the gender mainstreaming-based blended learning flipped classroom model was lower than conventional learning models.

The Problem-Solving Ability of students taught by the gender mainstreaming-based blended learning flipped classroom model was different from conventional learning models. These differences were significant, and the average Problem-Solving Ability of students taught with the gender mainstreaming-based blended learning flipped classroom model was 32.42, which looks higher than conventional learning at 23.39 $(\mu_{A1} > \mu_{A2})$.

4.2. Discussion

The analysis of data showed that the blended learning flipped classroom model based on gender mainstreaming met the criteria for being valid and effective, as judged by validators. The observation results showed that the value of teacher activity acquisition in the Lesson Plan for the observation category was still in the good category. Next, when testing the product, this learning model also gets effective criteria to improve students' problem-solving abilities.

Learning using the gender mainstreaming-based blended learning flipped classroom model has 2 conditions, namely pre-class and in-class. Pre-class learning involves watching videos outside the classroom. The video reflects a more effective absorption of information by using the senses of sight and is distributed through chat media. This is under the development of 21st-century education since learning involves the internet or technology.

According to some findings, Blended Learning combines online and face-to-face methods, whereas Flipped Classroom inverts the roles of instructors and students during the learning process. Materials are presented online prior to class meetings, with class time devoted to discussion, collaboration, and concept application [39-42].

Problem-solving ability is an essential skill in modern life. Learning models that encourage students to actively think, analyze, and find solutions strengthen their abilities. This aligns with some literature stating that Blended Learning Flipped Classroom gives students more opportunities to face challenges and design solutions. Furthermore, a gender mainstreaming approach can open up broader insights into understanding various perspectives [43-45].

The Blended Learning Flipped Classroom approach encourages students to become more independent in understanding concepts and solving complex problems. By involving gender mainstreaming, students are invited to understand diverse perspectives on overcoming problems. This can train the ability to think critically and creatively, as well as improve the ability to solve more holistic problems [46-48].

Solidarity refers to the spirit of togetherness, mutual care, and support between individuals. Blended Learning Flipped Classroom encourages collaboration among students through group discussions and projects, which can strengthen the value of solidarity [49-51].

In the Blended Learning Flipped Classroom approach, students face more intense collaboration opportunities. Online discussions open up space for diverse thinking, while group work strengthens social connections. When backed up by an inclusive culture and gender mainstreaming, this model can increase the value of solidarity by encouraging deeper understanding between people.

5. Conclusion

In conclusion, a gender mainstreaming-based blended learning flipped classroom model was conducted to improve problem-solving skills and a sense of solidarity. The ability to solve problems by using the model reported an increase in learning achievement of 86.11%.This was consistent with the results of inferential statistical calculations through the t value for the learning factor of 7,322 since $tcount = 7.322 > t_{table} = 2.042$ at a significance level of 0,000. Furthermore, problem-solving ability of students taught by the blended learning model was higher than that of conventional learning models. The ability of the teacher to manage learning with the gender mainstreaming-based blended learning flipped classroom model met good criteria, with a value of 4.4. Therefore, the set success criteria were met since the NKG score was greater than or equal to 3.

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