

## The Effect of Flipped Classroom Based STEAM Approach on Mastery of Concepts and Interpersonal Intelligence in Online Learning

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### Article Info

#### History Articles

Received:

5 January 2021

Accepted:

4 February 2021

Published:

31 June 2021

#### Keywords:

Flipped Classroom,

STEAM approach,

Concept

Understanding,

Interpersonal

Intelligence

### Abstract

Innovative learning in the independent learning period from home by utilizing features in online applications in the learning process. The purpose of this study was to analyse the effect of the implementation of the flipped classroom model on concepts mastery and interpersonal intelligence of students. The research used quantitative approach with a quasi-experimental design non-equivalent control group design. The population in this study were 5<sup>th</sup> grade. The sample were 100 students consisting of four classes. Two experimental classes were given flipped classroom and STEM approach and two control classes were given regular learning. The samples were chosen with sampling purposive technique. Data collection techniques used test techniques (multiple choice questions) and non-test (observation sheets, questionnaires, interviews, documentation). Data analysis techniques are prerequisite test, one-way ANOVA test and hypothesis t-test. The results of the average research test in the experimental class of concept understanding were 89.52 and interpersonal intelligence was 85.64, while in the control class, understanding of concepts was 77.08 and interpersonal intelligence was 64.74. Based on these findings, it can be concluded that there are significant effects and differences using the STEAM approach-based flipped classroom model in online mode to improve mastery concepts and interpersonal intelligence of students.

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## INTRODUCTION

Based on the Circular of the Ministry of Education and Culture No.4 of 2020 concerning the implementation of education policies in the emergency period of the spread of the coronavirus, it requires independent learning by students and transitioning from face-to-face learning in class to changing the pattern of independent online learning from home. Learning using flipped classrooms is very helpful in the independent learning process of students at home, this supports government policy (Hidayah, 2021).

The continuous application of the flipped classroom learning model carried out by the teacher in the online learning process can help strengthen the learning process in students so that it has a significant impact on students, this is evidenced (Walidah et al., 2020) with the application of flipped classrooms a significant effect on student learning outcomes assisted instructional video media learned before learning in class begins.

Kaviza (2019) defines that learning using flipped classroom model helps in fostering students' critical thinking skills towards learning it has an impact on student learning outcomes and learning motivation, this is proven by Rusnawati (2020) shows there are significant differences in student learning outcomes and motivation between classes using flipped classroom models with conventional classes.

Effective learners provide an experience to students through learning to foster enthusiasm in the learning process (Santriwati 2020). The use of a STEAM-based learning approach can provide a stimulus to students in a learning activity by honing students' science, technology, engineering, art and mathematics skills, using the STEAM approach to learning is expected to be able to prepare students to face future challenges.

Based on the results of online learning evaluations conducted during the second semester of the last semester in a State Elementary School in Nanga Pinoh, it shows that the level of boredom and boredom of

children increases so that the process of achieving the goals of learning is disrupted. This is supported by the results of interviews with two class teachers and ten students of 5th grade in State Elementary School 1 Nanga Pinoh. Several obstacles are conveyed related to problems during learning from home using online applications such as mastery of technology, the use of innovative learning models that are suitable for emergency conditions with minimal deployment integrated into independent learning from home.

Ideal learning is able to provide fun and interesting learning atmosphere and can minimize students' obstacles in online learning so that it contributes effectively in supporting students' abilities. Prameswari (2020) mentioned in the results of his research that 4C skills and concept mastery skills can be improved through STEAM approach. Sarwi (2013) defines that a highly effective class is demonstrated by the most students' achievement of a competency in the learning process in the class.

The success of a learning form of abilities such as concept mastery and interpersonal intelligence. Concept mastery ability is very important to always be applied in learning, (Praptiwi et al., 2012) mentions that concept mastery is a success in the process of learning activities in schools.

The learning process so far has only focused on explaining the material in the classroom and giving assignments to students after the teacher explains the learning material in the classroom. This learning process is often called the traditional learning process, this model is inversely proportional to the model used by researchers in this study, namely by using The flipped classroom learning model based on the STEAM approach learning online by utilizing online application platforms.

The things that conducted by teacher in online learning used flipped classrom is prepare learning materials related to what will be learned in the classroom, creation process, learning materials and videos are prepared to be shared with students before the learning class begins.

The material that the teacher has given to learn students at home is a breakthrough where students understand the learning materials and videos so that in the learning process students are more actively interacting with the teacher by preparing some questions related to the materials and videos that have been shared by the teacher before the learning in class begins

The purpose of this study is to determine the influence of STEAM-based flipped classroom model on students' mastery of concepts and interpersonal intelligence in elementary school online learning.

## METHODS

This type of research is a quantitative quasi-experimental design. The design in this experimental research was a Nonequivalent control group design. This research was conducted in the second semester of 2020/2021, with a discussion of heat material and its changes. The population in this study were students of 5th grade students in State Elementary School 1 and 3 Nanga Pinoh.

The research was conducted on a sample of 100 students in 5th grade who were divided into two class groups, namely the experimental class group and the control class group. In the experimental class group, the researcher used online learning assisted by the flipped classroom model based on the STEAM approach, while in the control class the researcher used regular online learning that the teacher used. This research was conducted beginning with holding a pretest to the two study groups, then the researcher did six times the treatment of the two-class groups, then the researcher did a posttest and filled out a questionnaire for the two-class groups.

Indicators of concept understanding in this study students can Understand, Plan, Make, Prove, Compare, Conclude about the concept of calorific material and its displacement, while the interpersonal intelligence indicators in this study students can apply the capabilities of Social Sensitivity, Social Insight, Social Communication.

Data collection techniques using test techniques (multiple choice questions) and non-test (observation sheets, questionnaires, interviews, documentation). The learning treatment activity for the experimental class uses the flipped classroom model based on the STEAM approach. The data analysis technique used independent t-test and one-way ANOVA testing.

## RESULTS AND DISCUSSION

Learning by using the flipped classroom model by collaborating the STEAM approach to learning during the pandemic is an effective way of learning in accordance with the concept of self-learning from home using online application features to help the learning and learning process in elementary schools. Sarwi (2013) said that an effective class can basically be demonstrated by being able to achieve competence by most of the students in the class and the ability of students to master a concept of learning material.

The learning process begins with the student first learning the material related to the calorific and the transfer, then the student learns through the learning video and the material shared through, the teacher instructs the student to fill out the activity sheet during the learning of the learning material that has been shared. In the learning process in the classroom after students have studied the video material that has been shared with students. Then the teacher asks the students to present the questions that have been designed related to the material and the process of transferring heat used around the student's home, then the teacher asks the student to respond to the question that has been presented.

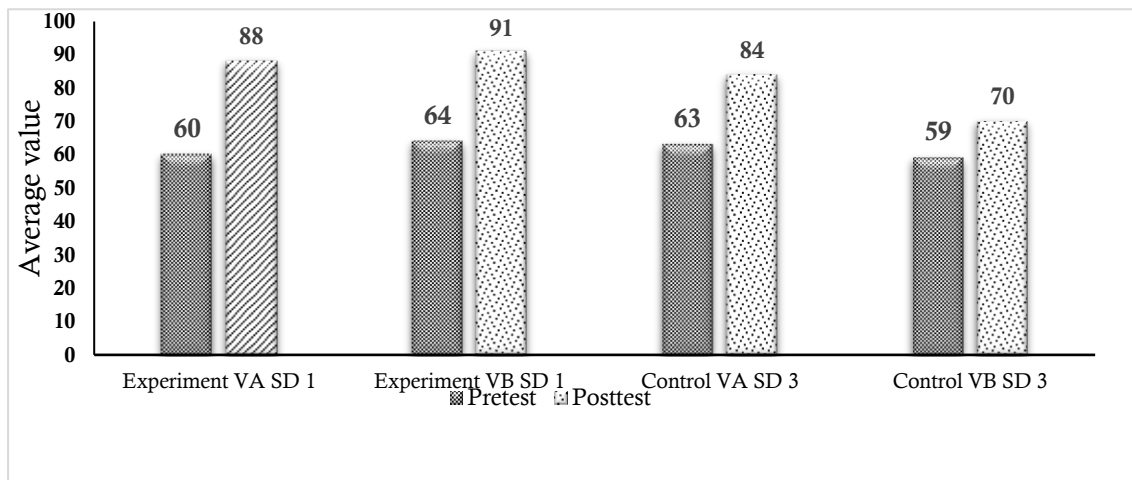
The learning process continues with discussion and questioning to train students to be able to accept and appreciate the efforts of their classmates by giving appreciation to their friends through applause and gratitude to foster sympathy and empathy towards friends and train of their friends in an effort to improve interpersonal intelligence skills in students.

Further learning activities students are directed to relearn and discuss the materials in

the learning video by integrating students' daily activities at home with the process of utilizing heat transfer in daily life, linking the utilization of heat in technology that can be used at home, instructing students how to use heat transfer techniques for utilization in the process of human life and then integrating art in the learning process by adding the role of how to see an object of aesthetic value of the form of change of objects influenced.

The application of learning uses the flipped classroom model based on the STEAM

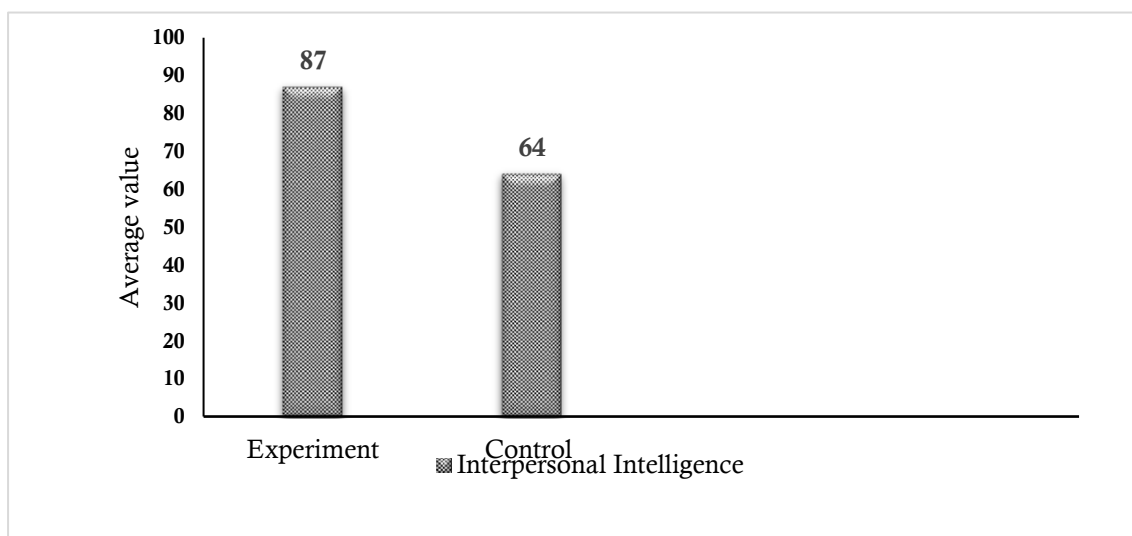
approach before application, students are given a pretest test after treatment with the model and the approach is then given a posttest. The ANOVA test results showed a significant difference in the mean understanding of concepts 89.52 and interpersonal intelligence 85.64 in the experimental class, while concept understanding was 77.08 and interpersonal intelligence 64.74 in the control class, while hypothesis testing tcount was 8.39 and 18.26 compared with t table 1.98. The test results can be seen in Figure 1.



**Figure.1** Mean value of concept understanding

Figure 1 shows the results of the test on students' conceptual understanding, then the results of the interpersonal intelligence

questionnaire for students can be seen in Figure 2 as follows.



**Figure.2** Mean value of interpersonal intelligence

The results of the graphic illustration can be explained that there is a significant difference in the mean value of the two classes in the experimental class with the control class, this

makes it fundamental that the experimental class uses the flipped classroom model based on the STEAM approach as shown in table 1.

**Table 1.** Results of the t-test

	Experiment Class	Control Class
Mean	89.52	77.08
Sampel	50	50
t count	8.29	
P(T<=t) one-tail	2.89	
t Critical one-tail	1.66	
P(T<=t) two-tail	5.79	
t table	1.98	

**The table on the t-test has the following criteria**

$H_0$

There is no influence and difference in online learning using the STEAM-based Flipped classroom model on the mastery of concepts and interpersonal intelligence with the online learning model used by the teacher.

$H_1$

There are effects and differences in online learning using the STEAM-based Flipped classroom model on students' mastery of concepts and interpersonal intelligence with online learning used by teachers.

Based on the results of the independent sample t-test, the significance value is 8.39. Because  $t_{count} > t_{table}$ ,  $H_0$  is rejected and  $H_1$  is accepted, which means that there are effects and differences in online learning using the STEAM-based Flipped classroom model on students' mastery of concepts and interpersonal intelligence with online learning used by teachers.

The use of the flipped classroom model is very helpful in the learning process in the classroom by first learning what material will be discussed in class, this makes flipped classroom very effective to use (Saputra et al., 2018). The integration of learning based on the STEAM approach is able to provide a stimulus to students in a learning activity by honing students' science, technology, engineering,

artistic and mathematical skills, using the STEAM approach to learning is expected to be able to prepare students for the Industry 4.0 revolution. Learning using the flipped classroom model with STEAM-based learning in optimizing educational transformation is a must for teachers, the role of the teacher board must be able to create a learning experience that provides students with experience, not only material to students but how to relate what is in learning to daily life -day.

So et al. (2019) proposed that the application of supporting STEAM for teachers develops positive attitudes towards appreciation of arts and science to foster teachers' creative convergence skills. A systematic approach is needed to support the development of STEAM in learning.

The research data was then carried out by testing the research prerequisites for the results of the student's mastery of concepts and interpersonal intelligence through test questions and questionnaires that the students were working on. The results of the prerequisite data analysis in supporting the validity of the data, the researchers tested the normality and homogeneity of the data and research subjects, the data from the pretest and posttest results on the conceptual mastery ability showed normal data, while the results of the students' interpersonal intelligence questionnaire showed normal data. Both of these data indicate normal

data by fulfilling the requirements of a normal data criterion.

Furthermore, the two experimental and control classes were subjected to a homogeneity test through the results of the acquisition of students' concept mastery and interpersonal intelligence tests by bathing the variance of values between the two classes, the homogeneity test data showed that the sample the researchers used met the homogeneous sample requirements. After the data meets the prerequisite test for normal data and homogeneous samples, then the t-test test: Two-Sample Assuming Equal Variances and one-way Anova to see the final results on the research objectives are as follows:

The results show that the flipped classroom model based on the STEAM approach has a significant effect on students' mastery of concepts and interpersonal intelligence in the online learning process in 5th grade elementary schools in the experimental class group compared to the control class group with conventional online learning models. The comparison of the results of the conceptual mastery of the two study class groups with the mean score at the pretest did not show any difference with the mean score in the experimental group class of 61.64, while the control class obtained an average pretest score of 61.34.

The two-class groups in this study had the same homogeneous level for each sample of this study before the online learning treatment was carried out using the flipped classroom model based on the STEAM approach in the experimental class group while the control group used conventional online learning. The comparison of the posttest results was 89.52 in the experimental class group while in the control class 77.08, from the mean value of the two classes it was seen that the experimental class group was more dominant than the control class group. This result is supported by the one way Anova test on the posttest results of understanding the concept by comparing the results of the F-count of 6.87 which is greater than the F-criteria of 3.97.

The results of calculations on the ability of interpersonal intelligence by comparing the questionnaire between the experimental class and the control class show a significant difference through the calculation of data analysis, namely the results make the starting point for the conclusion that there is an effect of the flipped classroom model based on the STEAM approach on students' understanding of concepts and interpersonal intelligence in the learning process.

Kurnianto (2019) stated in his research that one form of learning that is suitable for e-learning learning is using the flipped classroom method with the results of the student's research being more active in the learning process using the flipped classroom model in the e-learning process because students first understand the learning material Before class starts. Rusnawati (2020) states that there are significant differences in student learning outcomes and motivation between classes using the Flipped classroom model with conventional classes.

Lee (2018) found that by using the Flipped classroom model in classroom learning it provides significant insights related to encouraging more active classroom learning and improving student academic achievement. Lin et al., (2020) argued that the application of learning with STEAM can increase the ability of project competencies and student motivation.

Wardani (2016) stated that the problem with students' mastery of concepts is that learning is too centered on the teacher. The important role of the teacher is very dominant in increasing multiple intelligence in students with the help of videos, learning which is prepared by the teacher (Hajhashemi et al., 2018).

Arisanti et al. (2016) argued that develop knowledge and thinking skills on the mastery of concepts are greatly influenced by the learning style of the teacher. The flipped classroom learning model through strengthening learning with the help of video media and Moodle shows that a positive attitude in the flipped classroom has a correlation or relationship to increased motivation, involvement, and increased learning

in students who have a low achievement (Nouri, 2016).

Yang et al. (2020) stated that the use of the flipped classroom learning model is strongly influenced by the enthusiasm of student participation in the learning process in achieving abilities such as higher-order thinking. Training students to think at high levels, practicing communication, collaboration and critical thinking and be able to solve a problem, increase creativity and be able to develop students' thinking to become innovators to equip students for the era of society 5.0 can be done through the application of the STEAM approach (Ketut et al., 2020).

Zou (2020) found that in the learning process using the Gamified-assisted flipped classroom model can increase motivation and involvement as well as skill development and self-confidence and help in improving learning performance and learning outcomes with assisted learning. This is also supported by research results of Chen et al., (2019) that STEAM-based learning has a significant effect in fostering creative attitudes in students and being able to develop creative thinking by integrating the flipped classroom model and the STEAM approach into the curriculum.

Quigley et al. (2020) define that the application of innovative and collaborative learning that is integrated with the STEAM approach into the curriculum in schools is able to create different learning conditions and have quality in the learning process. Ortiz-Revilla et al. (2020) found that using the STEAM approach by compiling a framework in its application can provide a stimulus to students in developing thinking patterns by integrating various disciplines to provide learning experiences for students.

Widiyanto et al. (2015) stated that describing experiences has an impact on students' mastery of a learning material taught by the teacher. According to Nisa et al. (2019), the importance of increasing interpersonal intelligence in students is considered very important to be developed and improved. Increasing students' interpersonal intelligence

skills can improve learning outcomes at school. Amitha (2016) defines that there is a significant relationship between students' interpersonal intelligence abilities and learning outcomes.

Widiawati et al. (2015) said that learning using the flipped classroom model is a learning model that instructs students to study material that is distributed by the teacher to study at home before learning begins. Learning uses the flipped classroom model, which is the opposite of conventional learning that is often used in schools. Meanwhile, according to Johnson (2013) learning using a flipped classroom can maximize learning with students oriented first to learn the material that will be delivered by the teacher so that learning will be more effective.

The continuous application of the flipped classroom learning model carried out by the teacher in the online learning process can help strengthen the learning process for students so that it has a significant impact on students. Walidah et al. (2020) said the implementation of flipped classrooms had a significant effect on student learning outcomes with the help of instructional video media that were studied before learning in class began.

Effective learning provides an experience to students through a lesson in learning to foster enthusiasm in the learning process. The use of a STEAM-based learning approach is able to provide a stimulus to students in a learning activity by honing students' science, technology, engineering, art and mathematics skills, using the STEAM approach to learning is expected to be able to prepare students to face the Industry 4.0 revolution.

Prameswari (2020) states that the STEAM approach is very influential for students in preparing for the ability to face the Industry 4.0 Revolution and mastery of concepts by getting used to learning using the STEAM approach to learning.

The application of the STEAM approach suppresses students' habits in learning with various conceptual approaches to be able to provide a stimulus to increase student abilities such as mastery of concepts and interpersonal intelligence. Ketut (2020) explains that by

refining the learning approach in improving students' critical thinking skills by using the STEAM approach, it is able to realize the quality of human resources, thus creating competitive and Pancasila-spirited humans in the era of disruption.

To strengthen STEAM learning, there are several aspects to be considered, starting from teacher mastery related to learning using the STEAM approach to the important role of parents in helping the effectiveness of online learning while studying at home. Sari et al. (2019) proved that the STEAM approach with the results of their research that the process of educating and stimulating children's development at home such as mastery of concepts and interpersonal intelligence in children is very effective to be implemented.

The implementation of the STEAM approach in the online and offline learning process is very helpful in the process of developing students' skills in preparing 21st-century skills in learning. Mu'minah et al. (2020) explained in the results of their research that implementing the STEAM approach in learning, especially science learning in schools for teachers, is very useful in implementing the learning process with an approach.

The STEAM learning approach can develop a skill for students by integrating thematic learning using the STEAM approach. Zakiyatul (2020) states that in his research, developing critical and creative thinking skills with the development of a learning process using the STEAM approach is very effective in helping develop students' abilities in understanding concepts and increasing interpersonal intelligence is an ideal learning achievement.

The ideal learning is learning that can make an effective contribution in supporting students' abilities. that the ability of 4C (creativity, communication, collaboration, critical thinking) and the ability to master concepts can be improved through the STEAM approach which continues to be applied to the learning process by utilizing simulation practice in the learning process related to the material being studied.

Hajhashemi (2018) argued that the ability to master concepts and students' interpersonal intelligence needs to be trained so that students have an adequate level of ability in the learning process to give students the ability to increase their self-capacity so that they can give positive values in society and the achievement of educational goals. The ability to master concepts is very important to always be applied in learning. so that learning that is informative is not good enough to be done in the classroom.

Rahmah et al. (2018) explained that the informative learning process has an impact on passivity in the learning process so that mastery of the concept of science learning in elementary schools. The ability to master concepts is important for students to have in the learning process, mastery of concepts is one of the cores of a learning process (Marlina et al., 2017) so it is very important to note that it is very important for teachers to pay attention to the learning process. Mastery of concepts in the learning process makes students have the ability to manage students' cognitive skills and interpersonal intelligence skills (Ramdani et al., 2020).

Interpersonal intelligence is an intelligence that has an important role to be trained and improved for students so that it has a positive impact on students. (Nurmasdalifah, 2019) stated in the results of his research that the level of interpersonal intelligence affected student achievement, students who had adequate interpersonal intelligence obtained high learning outcomes compared to students with low levels of interpersonal intelligence.

Amitha (2017) found that interpersonal intelligence in students greatly determines skills in students so it is important for teacher awareness to understand and practice the concept of intelligence of students. One of the interpersonal intelligence such as the ability to communicate greatly contributes to learning, research results (Sagita et al., 2020) amounting to 54.1% of the contribution of interpersonal communication skills to the conclusion that interpersonal communication affects the competence of scientific knowledge of 5th grade



in State Elementary School 1 Nanga Pinoh students.

Hidayah et al. (2021) stated that the use of the flipped classroom model can accommodate the learning process during independent learning from home so that the importance of teacher understanding of the use of innovative learning models by integrating a collaborative approach by integrating various disciplines in the learning process to train and improve concept mastery skills and interpersonal intelligence in students in elementary schools during the independent learning period from home.

The online learning process is carried out independently from home through an online application platform using a flipped classroom model based on the STEAM approach which has an effect of 10.50% compared to learning from home through an online application platform using models and regular learning approaches in the learning process with an effective value of 3.50%. This can be seen from the comparison between the posttest and the questionnaire results of the two classes. thus an innovative learning model that is by the concept of independent learning is needed in the learning and learning process during the pandemic emergency.

## CONCLUSION

Based on the data analysis, it can be concluded that learning during the pandemic spread of the covid-19 virus is not an obstacle that is too difficult even make an opportunity in designing learning that corresponds to the concept of self-learning assisted by the online. Platform application using flipped classroom model based on a STEAM approach that has a significant influence on the mastery of concepts and interpersonal intelligence of students in the online learning process utilizing application features with regular online learning those teachers use in schools. questionnaires result of both classes with an average test a class score of 89.52 while the average control class score is 77.08.

## ACKNOWLEDGMENT

The researchers would like to thank the head of the Education Office and the principal and teachers of SD Negeri 1 and SD Negeri 3 Melawi Regency.

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