



Improving Arm Muscle Strength Through the Application of the STAD Cooperative Learning Model in Students in Grades X-3 of SMA Negeri 1 Banjarbaru

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Abstract

This study aimed to improve the arm muscle strength of students in Class X-3 at SMA Negeri 1 Banjarbaru through push-up training implemented using the Student Teams Achievement Division (STAD) cooperative learning model supported by audiovisual media. Although STAD and audiovisual media have frequently been used to enhance student engagement, limited classroom action research has examined their combined application with progressively varied push-up exercises in senior high school physical education. The study employed a classroom action research design conducted in two cycles and involved 35 students during the second semester of the 2025/2026 academic year. Data were collected through observation, a 60-second push-up performance test, and documentation. During the pre-cycle stage, students completed the exercises without instructional intervention. In Cycle I, the intervention incorporated the STAD model, audiovisual demonstrations, and several push-up variations. In Cycle II, the number of repetitions for each exercise was increased progressively. The results showed that classical mastery improved from 31% in the pre-cycle stage, involving 11 students, to 54% in Cycle I, involving 19 students, and further increased to 86% in Cycle II, involving 30 students. Correspondingly, the proportion of students who had not achieved mastery decreased from 69% to 46% and then to 14%. These findings indicate that STAD-based cooperative learning, supported by audiovisual media and progressive repetition, contributed to improved arm muscle performance in the observed classroom context.

Keywords: Arm Muscle Strength; STAD Cooperative Learning; Audiovisual Media; Push-Up Exercises.

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INTRODUCTION

Physical education is a systematically organised learning process that uses physical activity to support students' cognitive, physical, and perceptual development. In school settings, physical education includes physical-fitness content intended to improve students' capacity to perform physical activities without experiencing excessive fatigue (Aulia et al., 2022). Physical fitness consists of several interrelated components, one of which is muscular strength. Developing muscular strength is important because it supports students' performance in physical education, sports activities, and everyday movement.

At the senior-high-school level, strength training constitutes an important component of Physical Education, Sports, and Health (PJOK). Push-ups are a body-weight exercise commonly used to train the upper-body muscles, particularly the muscles of the arms, shoulders, and chest. Regular push-up training may contribute to improvements in students' muscular strength and endurance (Diwa & Irsyada, 2025). Push-ups are also classified as a form of strength training because they require the muscles to overcome resistance generated by body weight (Zaroh et al., 2024). Arm muscles comprise groups of muscles located in the upper arm and forearm that contribute to movement, postural control, and physical actions such as pushing, pulling, lifting, and supporting loads. Arm muscle strength refers to the capacity of these muscles to generate force against resistance (Diwa & Irsyada, 2025). This capacity is essential not only in sports participation but also in daily activities requiring upper-body control and stability.

Although push-ups are relatively simple to perform, students may experience difficulty when the exercise is taught only through verbal explanation or repetitive individual practice. Incorrect body alignment, incomplete elbow flexion, poor hand placement, and inconsistent movement rhythm can reduce exercise effectiveness and increase the risk of improper technique. Therefore, physical-fitness instruction should not focus exclusively on the number of repetitions completed. It should also provide students with clear movement demonstrations, opportunities for guided practice, corrective feedback, and progressive exercise loads suited to their abilities.

One instructional approach that may support these requirements is the Student Teams Achievement Division (STAD) cooperative learning model. STAD organises students into heterogeneous groups and encourages them to learn through class presentations, teamwork, individual responsibility, progress evaluation, and group recognition. In PJOK learning, this model has been reported to support social interaction, individual accountability, learning motivation, and cooperation in mastering movement skills (Suhendra et al., 2023). The model also allows students with stronger movement skills to assist peers who experience difficulty, while each group member remains responsible for personal improvement. Cooperative learning using STAD has also been applied to support skill learning in physical education contexts (Muhlisin et al., 2021).

Preliminary observations conducted during teaching-practice activities in Class X-3 of SMA Negeri 1 Banjarbaru revealed several problems related to students' arm muscle performance and participation in push-up exercises. Of the 35 students, only 11 students, or 31%, achieved the minimum mastery criterion, whereas 24 students, or 69%, had not reached the expected standard. Many students performed push-ups using improper techniques, including misaligned body positions, insufficient elbow flexion, and inconsistent movement rhythms. Several students also appeared less enthusiastic, became fatigued quickly, and showed limited motivation during the exercise activities.

These conditions indicate a gap between the expected learning outcomes and the actual performance of students. Ideally, students should demonstrate appropriate physical-fitness levels, correct movement techniques, and active engagement during PJOK learning. However, the preliminary results showed that most students had not yet achieved the expected performance standard. The low level of mastery, combined with limited motivation and incorrect technique, suggested that the existing learning process had not provided sufficient instructional support, movement modelling, peer assistance, or gradual exercise progression.

Rapid technological development has created new opportunities for improving the quality of learning through the use of instructional media (Muzaini et al., 2024). Learning media can support teaching by presenting information in forms that are clearer, more accessible, and more engaging for students (Mubarok et al., 2021). In physical education, audiovisual media are particularly relevant because movement techniques can be presented through demonstrations that students may observe repeatedly. Video-based demonstrations can help students identify correct body alignment, hand positioning, elbow movement, and execution rhythm before practising the movement independently or in groups.

The use of audiovisual media may also increase students' attention, motivation, and involvement in learning. When combined with STAD, audiovisual media provide a shared visual reference that students can use during group discussions and peer correction. STAD emphasises student interaction and mutual support, whereas audiovisual media facilitate information processing by presenting movement patterns more concretely. The STAD stages including class presentation, teamwork, individual evaluation, progress scores, and group recognition also ensure that each student remains accountable for personal and group achievement (Isfatiyah & Setyawan, 2026). In physical-fitness learning, audiovisual media have generally been used to demonstrate movements through video tutorials and to communicate instructional content more effectively (Wati et al., 2022).

Nevertheless, the use of STAD and audiovisual media alone may not be sufficient to improve physical performance if the exercises are not designed progressively. Muscle development requires repeated practice and gradual adjustment of exercise demands. In push-up learning, students may begin with movements of lower difficulty before progressing to more demanding variations. Exercises such as full planks, plank shoulder taps, wall push-

ups, and incline push-ups can provide a gradual pathway for developing body control, movement confidence, and upper-body muscular capacity. Repetition can then be increased systematically as students adapt to the exercise demands.

The novelty of this study lies in the integration of the STAD cooperative learning model, audiovisual movement demonstrations, peer-assisted technique correction, progressive push-up variations, and systematically increased repetitions. Rather than treating push-up practice as an individual and repetitive activity, the intervention positioned students as active group members who observed, practised, provided feedback, and supported one another. The combined approach was expected to improve movement accuracy, learning motivation, group responsibility, and arm muscle performance.

Accordingly, this study addressed two research questions. First, how was the STAD cooperative learning model supported by audiovisual media implemented in Class X-3 of SMA Negeri 1 Banjarbaru? Second, to what extent did the implementation of STAD-supported cooperative learning, audiovisual media, and progressive push-up exercises improve students' learning mastery in arm muscle strength material?

This study aimed to improve the arm muscle performance of students in Class X-3 of SMA Negeri 1 Banjarbaru through push-up exercises implemented using the STAD cooperative learning model, audiovisual media, peer support, and progressive repetition. The study was also intended to improve students' understanding of correct push-up techniques and increase their active participation in physical-fitness learning.

The findings are expected to benefit students, teachers, and schools. For students, the intervention may support the development of arm muscle strength and endurance, improve push-up technique, and strengthen understanding of physical-fitness concepts. For teachers, the study may provide an alternative instructional strategy that combines cooperative learning, movement demonstrations, peer feedback, and progressive exercise. For schools, the study may contribute to improving the quality of PJOK learning and support the development of innovative, active, and student-centred physical education practices. The findings may also serve as a preliminary reference for other teachers seeking to adapt cooperative and technology-supported approaches to physical-fitness instruction.

METHOD

Research Design

This study employed Classroom Action Research (CAR), which is conducted by teachers or researchers within a classroom setting to examine the effects of planned instructional actions on students' learning processes and outcomes (Azizah & Fatamorgana, 2021). The study was implemented during the second semester of the 2025/2026 academic year and consisted of a pre-cycle stage followed by two action cycles. Each cycle comprised four interconnected stages: planning, action implementation, observation, and reflection. The results of each cycle were used to identify weaknesses in the instructional process and determine improvements for the subsequent cycle.

Research Setting and Participants

The study was conducted in Class X-3 of SMA Negeri 1 Banjarbaru. The participants were all 35 students enrolled in the class. The class was selected purposively because preliminary observations indicated low mastery of push-up performance and frequent errors in movement technique. Because the study focused on improving learning within one specific classroom, the participants were treated as the research subjects rather than as a statistically representative sample of the entire school population.

Pre-Cycle Procedure

During the pre-cycle stage, all 35 students completed an individual push-up test for 60 seconds. The test was administered without the use of the STAD cooperative learning model, audiovisual media, peer-assisted learning, or progressive exercise variations. This stage was intended to obtain baseline data on students' initial push-up performance and identify common technical difficulties before the intervention was implemented.

Only repetitions completed with the prescribed technique were counted. The pre-cycle results were subsequently used as a reference for calculating individual progress and comparing learning mastery across the action cycles.

Cycle I Procedure

Cycle I was conducted over two meetings using the Student Teams Achievement Division cooperative learning model. The 35 students were organised into seven heterogeneous groups, each consisting of five members. Group composition was arranged to provide variation in students' initial abilities and encourage peer support.

The action began with a class presentation. The teacher used audiovisual media, including a projector and speakers, to present videos demonstrating the correct push-up technique and four progressively structured upper-body exercises. Each exercise was presented in a separate segment so that students could observe the movement pattern before beginning practice.

During the teamwork stage, students practised at their respective group stations. The exercise sequence consisted of the full plank, plank shoulder tap, wall push-up, and incline push-up. Each movement was completed for five repetitions. Group members observed one another's performance and provided immediate corrective feedback by referring to the techniques demonstrated in the instructional videos.

At the end of Cycle I, each student individually completed a 60-second push-up performance test. Individual progress scores were calculated by comparing the Cycle I results with the pre-cycle scores. The individual progress scores of all group members were then averaged to obtain a group score. The group achieving the highest average progress score received recognition from the teacher as a form of appreciation and motivation.

Observations were conducted throughout the cycle to examine the implementation of the STAD stages, student participation, peer interaction, and difficulties encountered during practice. The findings were then analysed during the reflection stage and used to improve the implementation of Cycle II.

Cycle II Procedure

Cycle II retained the same STAD structure applied in Cycle I, including heterogeneous grouping, class presentation through audiovisual media, teamwork, individual evaluation, progress-score calculation, and group recognition. The exercise sequence also remained unchanged, consisting of the full plank, plank shoulder tap, wall push-up, and incline push-up.

The main improvement in Cycle II was the increase in exercise volume from five to ten repetitions for each movement. This adjustment was intended to provide a progressively greater training stimulus and support continued muscular adaptation. The increase in repetitions was implemented gradually and accompanied by teacher supervision to maintain movement quality and student safety.

Peer-assisted correction was also strengthened through the use of a simple movement-observation sheet. Each group member used the sheet to monitor body alignment, hand position, elbow movement, movement rhythm, and completion of the prescribed repetitions. At the end of the cycle, students again completed an individual 60-second push-up test, and their progress scores were compared with the previous results.

Research Instruments

The study used three principal instruments. The first was an observation sheet for teacher and student activities, which was used to monitor the implementation of the STAD stages and students' involvement during learning. The second was a push-up performance test based on the Indonesian Physical Fitness Test rubric. The test was administered at the pre-cycle stage and at the end of each action cycle. The third instrument consisted of documentation in the form of photographs, videos, and learning records used to support the observational and performance data.

Before implementation, the observation sheets and assessment rubric were reviewed by the supervising lecturer and the participating school teacher. The review focused on the relevance of the indicators, clarity of instructions, and suitability of the instruments for the research objectives.

Data-Collection Techniques

Data were collected through direct observation, performance testing, and documentation. Direct observation was conducted by the collaborating teacher during the learning process to record the implementation of the instructional actions and students'

participation. Performance data were obtained through the 60-second push-up test administered during the pre-cycle stage and at the end of Cycles I and II. Documentation was used to record the learning process and support the interpretation of the observational findings.

Push-Up Performance Assessment

The push-up test was administered for 60 seconds using different performance standards for male and female students. Only repetitions performed using the required technique were counted. The technical criteria included maintaining a straight body position, placing the hands appropriately, bending the elbows sufficiently, and completing the movement through the required range.

Students who achieved a score of three or higher, corresponding to the “good” category, were classified as having achieved learning mastery. The push-up test was used as the operational indicator of students’ arm muscle performance within the context of this study.

Table 1. Push-Up Performance Assessment Rubric

Score	Male students	Female students	Category
5	>38 repetitions	>21 repetitions	Excellent
4	29–37 repetitions	16–20 repetitions	Very good
3	20–28 repetitions	10–15 repetitions	Good
2	12–19 repetitions	5–9 repetitions	Sufficient
1	4–11 repetitions	1–4 repetitions	Poor

Data-Analysis Procedures

The data were analysed using quantitative descriptive analysis supported by qualitative interpretation of the observation and reflection records. The percentage of classical learning mastery was calculated using the following formula:

$$\text{Classical mastery} = \frac{\text{Number of students achieving a score of } \geq 3}{\text{Total number of students}} \times 100\%$$

The mean performance score was also calculated for the pre-cycle stage and each action cycle to identify the direction of improvement. Observation and documentation data were used to explain changes in student participation, movement technique, peer support, and responsiveness to the intervention.

The action was considered successful when at least 85% of the students achieved a score of three or higher. Improvement was also evaluated by comparing the percentages of mastery and mean scores across the pre-cycle stage, Cycle I, and Cycle II.

RESULTS AND DISCUSSION

Results

Based on the data obtained from the classroom action research entitled “Improving Arm Muscle Strength of Grade X-3 Students through Push-Up Exercises Using the STAD Cooperative Learning Model Assisted by Audiovisual Media at SMA Negeri 1 Banjarbaru,” student performance increased across each cycle.

Pre-Cycle Results

Table 2. Pre-Cycle Data Results

Criteria	Number of Students	Percentage
Less	3	9%
Enough	9	26%
Good	12	34%
Excellent	11	31%
Perfect	0	0%
Total	35	100%

During the pre-cycle stage, students performed push-up exercises without the support of a learning model, audiovisual media, or a group-based approach. The results showed that only 11 students, or 31%, achieved the completion criterion, whereas the remaining 24 students, or 69%, were classified as incomplete. Based on the arm muscle strength criteria,

three students, or 9%, were classified in the less category; nine students, or 26%, were in the enough category; 12 students, or 34%, were in the good category; 11 students, or 31%, were in the excellent category; and no students achieved the perfect category.

Cycle I Results

Table 3. Cycle I Data Results

Criteria	Number of Students	Percentage
Less	0	0%
Enough	5	14%
Good	11	31%
Excellent	19	54%
Perfect	0	0%
Total	35	100%

In Cycle I, the STAD cooperative learning model was implemented with the support of audiovisual media and group exercises consisting of the full plank, plank shoulder tap, wall push-up, and incline push-up. The results showed an increase in learning completion to 19 students, or 54%, while 16 students, or 46%, had not yet achieved completion. Based on the arm muscle strength criteria, no students were classified in the less category, five students, or 14%, were in the enough category, 11 students, or 31%, were in the good category, 19 students, or 54%, were in the excellent category, and no students reached the perfect category. This improvement indicates that the application of the cooperative learning model and audiovisual media had a positive effect, although the results were not yet optimal because several students were still unfamiliar with the new movement variations.

Cycle II Results

Table 4. Cycle II Data Results

Criteria	Number of Students	Percentage
Less	0	0%
Enough	2	6%
Good	3	9%
Excellent	28	80%
Perfect	2	6%
Total	35	100%

In Cycle II, the same STAD cooperative learning model and audiovisual media were applied, with the addition of repetitions for each exercise. The results showed a very significant improvement. The number of students who achieved completion increased to 30 students, or 86%, while only five students, or 14%, remained incomplete. Based on the arm muscle strength criteria, no students were classified in the less category, two students, or 5.7%, were in the enough category, three students, or 8.6%, were in the good category, 28 students, or 80%, were in the excellent category, and two students, or 5.7%, were in the perfect category.

Overall Results

Table 5. Results Across All Cycles

Completion Classification	Pre-Cycle	Cycle I	Cycle II
Complete	11 (31%)	19 (54%)	30 (86%)
Incomplete	24 (69%)	16 (46%)	5 (14%)
Average Score	73	79	84

Discussion

The progressive improvement in students' push-up performance from the pre-cycle stage to Cycle II indicates that the instructional intervention was associated with better learning outcomes. The intervention combined the STAD cooperative learning model, audiovisual movement demonstrations, progressive exercise variations, and increased repetition. During the pre-cycle stage, the low level of learning mastery appeared to be related to students' limited understanding of correct push-up technique, low initial upper-body muscular capacity, and the absence of structured learning support that encouraged active participation. After the implementation of STAD in Cycle I, learning mastery increased from 31% to 54%. This

improvement may have occurred because students were provided with opportunities to learn collaboratively within groups. Through discussion, movement observation, and peer feedback, students were able to identify technical errors, support one another, and strengthen their motivation to practise. Because group success in STAD depends on the contribution of every member, students were encouraged to assist peers who experienced difficulty. During the learning process, students who had better mastery of push-up techniques helped their group members correct body position and movement execution, thereby creating a more active and supportive learning environment.

In addition to the cooperative-learning structure, audiovisual media contributed to the improvement in students' performance. Demonstration videos enabled students to observe correct push-up techniques repeatedly and more clearly understand body alignment, hand placement, elbow movement, and execution rhythm. Compared with verbal explanation alone, audiovisual demonstrations provided concrete movement models that students could use as references during practice. This finding is consistent with Hadiana et al. (2020), who reported that video feedback in PJOK learning could increase learning motivation and support the improvement of movement skills through observation and self-evaluation. In the present study, audiovisual media not only strengthened students' understanding of movement techniques but also enabled them to identify and correct errors more independently. However, the contribution of audiovisual media should be understood as part of the broader instructional design because the videos were used together with group learning, peer feedback, exercise variation, and teacher guidance.

The greater increase in learning mastery during Cycle II, from 54% to 86%, suggests that progressive and repeated exercise also played an important role. In Cycle II, the number of repetitions for each exercise was increased so that students received a greater training stimulus than in Cycle I. This gradual increase in exercise volume reflected the principle of progressive overload, which allows the body to adapt to increasingly demanding physical stimuli. Consistent repetition may also have supported neuromuscular adaptation by improving movement coordination, body stability, and muscular efficiency. Consequently, students not only showed better physical performance but also became more proficient in executing push-ups with the correct technique. This interpretation is supported by Cahyono et al (2018), who found that traditional push-ups, incline push-ups, and plyometric push-ups could improve arm-muscle strength, power, and endurance. These findings reinforce the view that gradually varied and repeatedly performed push-up exercises can contribute to the development of students' upper-body physical performance.

The findings are also consistent with Setiarufi (2021), who reported that the STAD cooperative learning model supported by audiovisual media could improve students' motivation and learning outcomes. The combination of cooperative learning and audiovisual support may create a more engaging learning environment because students are encouraged to observe, discuss, practise, and evaluate movement collectively. In the present study, the improvement in push-up performance was therefore not influenced solely by the physical exercises provided. It was also associated with increased motivation, active group participation, peer support, and individual responsibility. STAD contributed to the creation of positive social interaction, while audiovisual media provided a common technical reference that students could use during practice and correction. These two components therefore functioned complementarily in supporting both the learning process and students' physical performance.

The larger improvement observed in Cycle II may also indicate that students had progressed beyond the initial adaptation stage. During Cycle I, several students were still becoming familiar with the push-up variations, exercise sequence, group-learning procedures, and peer-feedback mechanisms. By Cycle II, students had developed a clearer understanding of the learning procedures, improved their mastery of basic movement techniques, and become physically better prepared to complete the increased number of repetitions. This gradual adaptation may explain why the improvement in Cycle II was greater than that observed in Cycle I. The finding suggests that learning success was shaped not only by the instructional model but also by students' continued adjustment to the exercise demands and cooperative-learning environment.

Despite the positive results, several limitations should be considered. First, the study involved only one class, so the findings cannot be generalised directly to broader student populations. Second, the absence of a control group means that the improvement in push-up performance cannot be attributed exclusively to the STAD model and audiovisual media. Repeated practice, teacher guidance, peer encouragement, increasing familiarity with the test, and progressive exercise volume may also have contributed to the observed changes. Third, the intervention was conducted over only two cycles, so its long-term effects remain unknown. Fourth, repeated testing may have produced a practice effect because students became increasingly familiar with the test procedures. Fifth, the 60-second push-up test may reflect not only arm-muscle strength but also muscular endurance, body stability, movement coordination, motivation, and technical execution. In addition, movement assessment may still have involved a degree of observer subjectivity. Future research should therefore include larger samples, control or comparison groups, longer intervention periods, and more objective measures of muscular performance to produce stronger and more generalisable evidence.

CONCLUSION

Based on the results of a class action study entitled "Improving the Arm Muscle Strength of Class X-3 Students through Push Up Exercises with the Application of the STAD Cooperative Model Assisted by Audio Visual Media at SMA Negeri 1 Banjarbaru", it can be concluded that the application of the STAD cooperative model assisted by audio visual media accompanied by the addition of reps has been proven effective in increasing the arm muscle strength of students in class X-3 of SMA Negeri 1 Banjarbaru. This is shown by an increase in completeness from 31% (pre-cycle) to 54% (cycle 1) and 86% (cycle 2), as well as an increase in the average score from 73 to 84. Thus, the action hypothesis that the application of the STAD cooperative model assisted by audio-visual media can increase the arm muscle strength of students in grades X-3 of SMA Negeri 1 Banjarbaru is accepted.

RECOMMENDATIONS

Based on the findings, Physical Education, Sports, and Health teachers are encouraged to apply the STAD cooperative learning model in combination with audiovisual demonstrations, peer-assisted feedback, and progressively varied push-up exercises to support students' upper-body muscular performance and active participation. The intervention should be implemented gradually, with careful attention to correct movement technique, exercise volume, student safety, and differences in initial ability. Schools should support this approach by providing adequate audiovisual equipment, suitable practice spaces, and opportunities for teachers to develop technology-assisted and cooperative learning strategies. Because the present study involved only one class, two action cycles, and no comparison group, future research should include larger and more diverse samples, longer intervention periods, and control or comparison groups. Researchers are also advised to use more objective measures of muscular strength and endurance, report inter-rater agreement for movement assessment, and distinguish clearly between maximum muscular strength, muscular endurance, and push-up performance. Further studies may also examine the separate and combined effects of STAD, audiovisual media, peer feedback, and progressive exercise to determine which components contribute most strongly to student improvement.

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