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The Effectiveness of the PAPEDA Warm-Up in Increasing PSTE Students' Motivation in Physical Education Lectures

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ABSTRACT

This study aimed to examine the effectiveness of the PAPEDA warm-up model in increasing the motivation of PGSD students in Physical Education lectures. The background of this study was the low motivation of students during conventional warm-up activities, which were considered monotonous and less engaging. This research used a quasi-experimental method with a *pretest-posttest* non-equivalent control group design. The participants were 59 third-semester PGSD students at Universitas Werisar, consisting of 29 students in the experimental group and 30 students in the control group. The experimental group received the PAPEDA warm-up model, while the control group received conventional warm-up activities. Student motivation was measured using an ARCS-based questionnaire covering *Attention*, *Relevance*, *Confidence*, and *Satisfaction*, with a Cronbach's alpha reliability value of 0.89. Data were analyzed using an independent sample t-test. The results showed that the experimental group's motivation increased by 50.3%, from 58.12 to 87.34, while the control group increased by only 11.5%, from 57.89 to 64.56. The difference was statistically significant with $p<0.001$. The highest increases occurred in *Attention* and *Satisfaction*. Therefore, the PAPEDA warm-up model was effective in increasing PGSD students' motivation in Physical Education lectures.

Informasi Artikel

Kata Kunci:

Pemanasan PAPEDA; motivasi mahasiswa; mahasiswa PGSD; PJOK; model ARCS.

ABSTRAK

Penelitian ini bertujuan untuk menguji efektivitas model pemanasan PAPEDA dalam meningkatkan motivasi mahasiswa PGSD pada perkuliahan PJOK. Penelitian ini dilatarbelakangi oleh rendahnya motivasi mahasiswa saat mengikuti kegiatan pemanasan konvensional yang cenderung monoton, kurang bervariasi, dan belum mampu membangkitkan kesiapan belajar. Metode penelitian yang digunakan adalah kuasi eksperimen dengan desain *pretest-posttest* non-equivalent control group. Subjek penelitian berjumlah 59 mahasiswa PGSD semester tiga Universitas Werisar, yang terdiri atas 29 mahasiswa kelompok eksperimen dan 30 mahasiswa kelompok kontrol. Kelompok eksperimen diberi perlakuan model pemanasan PAPEDA, sedangkan kelompok kontrol mengikuti pemanasan konvensional. Motivasi mahasiswa diukur menggunakan angket berbasis model ARCS yang mencakup *Attention*, *Relevance*, *Confidence*, dan *Satisfaction*, dengan nilai reliabilitas Cronbach's alpha sebesar 0,89. Analisis data menggunakan uji t independen. Hasil penelitian menunjukkan bahwa motivasi kelompok eksperimen meningkat sebesar 50,3%, dari 58,12 menjadi 87,34, sedangkan kelompok kontrol hanya meningkat sebesar 11,5%, dari 57,89 menjadi 64,56. Perbedaan tersebut signifikan dengan nilai $p<0,001$. Peningkatan tertinggi terjadi pada komponen *Attention* dan *Satisfaction*. Dengan demikian, model pemanasan PAPEDA efektif meningkatkan motivasi mahasiswa PGSD pada perkuliahan PJOK.

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1. Introduction

Physical Education, Sports, and Health (PESH) plays a vital role in developing students' motor skills, physical fitness, discipline, cooperation, and active lifestyle habits. In the higher education context, particularly within the Primary School Teacher Education (PSTE) study program, PESH is not only aimed at improving students' physical abilities but also equipping them with motor learning experiences that they can later apply as primary school teachers. Therefore, the PESH lecturing process needs to be designed actively, engagingly, and in accordance with the characteristics of pre-service teachers [1]. PSTE students need to gain learning experiences that are not only practical but also possess pedagogical value, enabling them to understand how to manage motor learning in a simple, safe, and enjoyable manner for primary school pupils [2].

One crucial part of PESH lectures is the warm-up activity. Warming up is an initial activity that functions to prepare the body before entering the core activities. However, in practice, warming up is frequently conducted conventionally, such as running around the field, static stretching, and repetitive movements without variation. While this pattern can assist in physical preparation, it often fails to arouse students' interest and motivation. A monotonous warm-up can cause students to become quickly bored, lose focus, and lack enthusiasm in participating in the lesson. Previous research indicates that game-based warm-ups have a positive influence on motivation to learn PESH because they can create a more active and enjoyable atmosphere [3].

An active warm-up impacts not only physical readiness but is also related to the psychological readiness of the learners. Warm-up activities involving movement variations, group interactions, and challenging activities can help increase attention, mental readiness, and participant engagement in learning. Hoffmann et al. explained that activities such as small-sided games, moderate-intensity exercises, and dynamic movements can be used to build body readiness and psychological engagement prior to the core activity [4]. Similarly, Araujo et al. demonstrated that an appropriate warm-up protocol can affect participant performance in sports activities, from both anaerobic and aerobic aspects [5]. Thus, warming up should not only be understood as an initial routine but as an important strategy to establish learning readiness.

Motivation is a crucial factor in the success of PESH lectures. Highly motivated students tend to be more active in following instructions, courageous in trying movements, capable of cooperating, and better prepared to participate in core learning activities. Conversely, low motivation can be seen from a passive attitude, lack of focus, slow response to instructions, and lack of enthusiasm in participating in activities. Low motivation in learning PESH can result in suboptimal student competence achievement, especially for pre-service teachers who ought to be equipped with good practical teaching experiences [6].

Based on preliminary observations of PSTE students at Universitas Werisar, South Sorong, Southwest Papua, it was found that student motivation in attending PESH lectures still needs improvement, particularly during the warm-up session. Several students appeared unenthusiastic, unfocused on the lecturer's instructions, engaged in off-task conversations, and performed warm-up movements half-heartedly. This condition indicates that conventional warm-ups have not been fully capable of serving as an engaging introductory activity that arouses students' readiness to participate in learning. This situation is important to address because low motivation at the beginning of the lecture can affect student engagement in the core activities.

Various studies indicate that game-based warm-up strategies can serve as an alternative to increase participation and the learning atmosphere. Gobatto et al. explained that warm-up strategies in team sports are not only related to physiological readiness but can also provide a positive psychological impact when designed actively and interactively [7]. Furthermore, educational games in fundamental motor learning have also been proven to increase learner engagement because physical activities are packaged in an enjoyable and meaningful form [8]. In the context of college students, active warm-ups also have the potential to increase learning motivation because students do not only move but also experience interaction, challenges, and more varied learning experiences [9].

Nevertheless, research on game-based warm-ups is still predominantly conducted on school pupils or sports science students. Research that specifically examines warm-up models for PSTE students remains limited. In fact, PSTE students possess different characteristics from sports science students. They are not prospective athletes or sports coaches, but rather future classroom teachers who will eventually need to teach PESH to primary school children. Therefore, the warm-ups provided to PSTE students need to incorporate physical, pedagogical, social, and motivational elements. Warm-up activities should not only get students moving but also provide examples of activities that they can replicate and modify when teaching.

Based on these needs, this study implements the PAPEDA warm-up model, which stands for *Pemanasan Aktif Permainan Edukatif Dinamis Menyenangkan* (Active, Educational, Dynamic, and Enjoyable Game-Based Warm-Up). This model is designed with four main elements. First, **active**, meaning all students are involved in movements during the warm-up activity. Second, **educational games**, meaning the warm-up activities are packaged in the form of games that possess learning value. Third, **dynamic**, meaning the activities are varied so that they are not monotonous from one meeting to the next. Fourth, **enjoyable**, meaning the warm-up atmosphere is made more cheerful through group games,

chants, motivational clapping, and activities that encourage social interaction. With these four elements, PAPEDA is expected to enhance student motivation from the very beginning of the lecture.

Motivation measurement in this study utilizes the ARCS model, which consists of four components: **Attention**, **Relevance**, **Confidence**, and **Satisfaction**. *Attention* relates to the ability of learning activities to capture students' interest. *Relevance* indicates the extent to which learning activities are considered in line with students' needs, experiences, and goals. *Confidence* relates to students' self-assurance in participating in activities, while *Satisfaction* relates to the sense of fulfillment after participating in learning. The ARCS model is relevant for use in this study because it can explain learning motivation in greater detail, rather than merely viewing motivation as a single general score [10]. The application of the ARCS model has also been used in PESH learning to observe how instructional design can affect learner motivation [11].

The novelty of this study lies in the application of the PAPEDA warm-up within the context of PSTE students at Universitas Werisar, South Sorong, Southwest Papua. This model differs from conventional warm-ups as it does not merely emphasize physical readiness, but also integrates elements of educational games, movement variations, cooperation, and an enjoyable atmosphere. Furthermore, this study does not only measure motivation in general but also analyzes the increase in motivation based on the four ARCS components. Thus, this study is expected to contribute to the development of a warm-up model that is simple, innovative, and suited to the characteristics of pre-service primary school teachers.

Based on the aforementioned background, the purpose of this study is to test the effectiveness of the PAPEDA warm-up in increasing the motivation of PSTE students in PESH lectures. Specifically, this study aims to determine the difference in motivation between students who undergo the PAPEDA warm-up and those who undergo conventional warm-ups, as well as to analyze which ARCS motivation component experiences the highest increase after the implementation of the PAPEDA warm-up

2. Method

2.1. Research Design

This study utilized a quantitative approach with a quasi-experimental method. The design employed was a pretest-posttest non-equivalent control group design. This design was selected because the research subjects were already in naturally formed classes, preventing the researcher from performing full randomization of the group members [1]. Through this design, the effectiveness of the PAPEDA warm-up was compared with that of the conventional warm-up, based on the students' motivation scores before and after the treatment.

Berikut adalah terjemahan bagian tersebut ke dalam bahasa Inggris akademik yang baik, benar, dan formal:

2.2. Research Location and Time

The study was conducted at Universitas Werisar, Teminabuan District, South Sorong Regency, Southwest Papua Province. The research was carried out over a period of ten weeks. The first week was allocated for administering the pretest and socializing the research procedures. The second through the ninth week were utilized to deliver the treatment across eight meetings, while the tenth week was dedicated to administering the posttest. Each PESH lecture meeting lasted for 100 minutes, with a 15-minute time allocation for the warm-up activity.

2.3. Population and Sample

The population in this study consisted of all third-semester students in the PSTE Study Program at Universitas Werisar during the 2025/2026 academic year who were enrolled in PESH lectures. The total population comprised 59 students, consisting of 50 female students and 9 male students within an age range of 19 to 22 years. The sampling technique used was total sampling; thus, the entire population was included as the research sample [1].

The sample was divided into two groups: an experimental group of 29 students and a control group of 30 students. The experimental group received the treatment in the form of the PAPEDA warm-up, while the control group received the conventional warm-up. The group assignment was based on existing classes so as not to disrupt the lecture schedules

Berikut adalah terjemahan bagian tersebut ke dalam bahasa Inggris akademik yang baik, benar, dan formal:

2.4. Research Treatment

The experimental group received treatment in the form of the PAPEDA warm-up model (Pemanasan Aktif Permainan Edukatif Dinamis Menyenangkan / Active, Educational, Dynamic, and Enjoyable Game-Based Warm-Up). This model was implemented for 15 minutes at the beginning of the PESH lectures. The PAPEDA activities consisted of three stages: opening, core, and closing.

In the opening stage, students were directed to gather, perform group chants, and receive a brief explanation of the games to be played. In the core stage, students participated in various educational games, such as fundamental movement relays, educational cat-and-mouse, chain ball, action cards, and group rope jumping. In the closing stage, students performed light stretching, motivational clapping, and a brief reflection on the values of cooperation and learning enthusiasm.

The control group underwent a conventional warm-up consisting of running around the field for five minutes, static stretching for eight minutes, and running in place for two

minutes. This warm-up was conducted individually without elements of games, music, chants, or group activities.

2.5. Research Instrument

The research instrument utilized a motivation questionnaire based on the ARCS model. The questionnaire consisted of 24 items, with six items for each component. A 5-point Likert scale was employed, ranging from strongly disagree, disagree, neutral, agree, to strongly agree.

The content validity of the instrument was evaluated by three experts: a PESH expert, an educational psychology expert, and a measurement expert. The validity test results yielded a Content Validity Index (CVI) value of 0.87. The reliability test using Cronbach's alpha obtained a value of 0.89. These values indicate that the instrument is appropriate and reliable for measuring student motivation.

2.6. Data Collection Procedure

The data collection procedure was carried out through several stages. First, the researcher obtained research clearance from the university and the study program. Second, the researcher socialized the research procedures to the students and requested their informed consent to participate as research subjects. Third, the researcher administered the pretest to both the experimental and control groups. Fourth, the researcher delivered the treatment across eight meetings. Fifth, the researcher administered the posttest using the same questionnaire to determine changes in student motivation following the treatment.

2.7. Data Analysis Technique

The research data were analyzed through three stages. The first stage was the prerequisite testing, which included a normality test using the Shapiro-Wilk method and a homogeneity test using Levene's test. The second stage was descriptive analysis to calculate the mean, standard deviation, gain score, and percentage increase in motivation. The third stage was hypothesis testing using an independent sample t-test to determine the difference in motivation between the experimental group and the control group [1]. The significance level used was 0.05. All data analyses were performed using SPSS version 26 for Windows.

3. results

3.1. Characteristics of Research Subjects

This study involved 59 third-semester students from the PSTE Study Program at Universitas Werisar. The experimental group consisted of 29 students, comprising 25 females and 4 males. The control group consisted of 30 students, comprising 25 females and 5 males. The mean age of the students in the experimental group was 20.4 years with a standard deviation of 1.1, while the mean age of the control group was 20.6 years with a standard deviation of 1.2.

The baseline equivalence test indicated that there were no significant differences between the two groups based on age or gender. The independent t-test for age differences yielded a value of $t = 0.67$ with $p = 0.506$, while the chi-square test for gender differences yielded a value of $\chi^2 = 0.30$ with $p = 0.584$. Consequently, the experimental and control groups can be declared to have relatively equivalent baseline characteristics prior to the treatment.

Tabel 1 Karakteristik Subjek Penelitian

Karakteristik	Kelompok Eksperimen	Kelompok Kontrol
Jumlah mahasiswa	29	30
Perempuan	25 mahasiswa	25 mahasiswa
Laki-laki	4 mahasiswa	5 mahasiswa
Rata-rata usia	20,4 tahun	20,6 tahun
Standar deviasi usia	1,1	1,2

3.2. Results of Prerequisite Analysis Testing

Prior to hypothesis testing, the data were first evaluated for normality and homogeneity. The normality test using the Shapiro-Wilk method indicated that both the pretest and posttest data for both groups were normally distributed, as all significance values were greater than 0.05. In the experimental group, the Shapiro-Wilk pretest value was 0.965 with $p = 0.421$, while the posttest value was 0.972 with $p = 0.612$. In the control group, the Shapiro-Wilk pretest value was 0.958 with $p = 0.298$, while the posttest value was 0.963 with $p = 0.386$.

The homogeneity test using Levene's test also demonstrated that the variances of the two groups were homogeneous. The Levene's test value for the pretest was $F = 0.231$ with $p = 0.633$, while for the posttest, it was $F = 0.542$ with $p = 0.465$. Based on these results, the data met the assumptions of normality and homogeneity; thus, the analysis could proceed using parametric statistics.

Tabel 2 Hasil Uji Normalitas dan Homogenitas

Uji Prasyarat	Data	Nilai Statistik	p-value	Keterangan
Shapiro-Wilk	*Pretest* eksperimen	0,965	0,421	Normal
Shapiro-Wilk	*Posttest* eksperimen	0,972	0,612	Normal
Shapiro-Wilk	*Pretest* kontrol	0,958	0,298	Normal
Shapiro-Wilk	*Posttest* kontrol	0,963	0,386	Normal
Levene's test	*Pretest*	0,231	0,633	Homogen
Levene's test	*Posttest*	0,542	0,465	Homogen

3.3. Comparison of Student Motivation Scores

The results of the descriptive analysis indicated that the baseline motivation scores of the experimental and control

groups were relatively balanced. The pretest score of the experimental group was 58.12 with a standard deviation of 7.08, while the pretest score of the control group was 57.89 with a standard deviation of 7.45. The baseline difference test showed no significant difference between the two groups, with $t = 0.12$ and $p = 0.876$.

After receiving the treatment for eight meetings, the motivation score of the experimental group increased to 87.34 with a standard deviation of 5.02. Meanwhile, the score of the control group increased to 64.56 with a standard deviation of 6.58. The independent sample t-test on the posttest scores revealed a highly significant difference between the experimental group and the control group, with $t = 15.23$ and $p < 0.001$. This indicates that students who underwent the PAPEDA warm-up exhibited significantly higher motivation compared to those who followed the conventional warm-up

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Tabel 3 Perbandingan Skor Motivasi *Pretest* dan *Posttest* Antar Kelompok

Variabel	Kelompok	*Pretest* Mean± SD	*Posttest* Mean± SD	Gain Score	Peningkatan	p-value
Motivasi	Eksperimen	58,12 ± 7,08	87,34 ± 5,02	29,22	50,3%	<0,001
Motivasi	Kontrol	57,89 ± 7,45	64,56 ± 6,58	6,67	11,5%	0,128

Based on Table 3, the gain score of the experimental group reached 29.22 points, whereas the control group only reached 6.67 points. In terms of the percentage increase, student motivation in the experimental group increased by 50.3%, while the control group only increased by 11.5%. Thus, the increase in motivation in the experimental group was more than four times higher than that of the control group. This finding indicates that the PAPEDA warm-up exerts a stronger influence on increasing student motivation compared to the conventional warm-up.

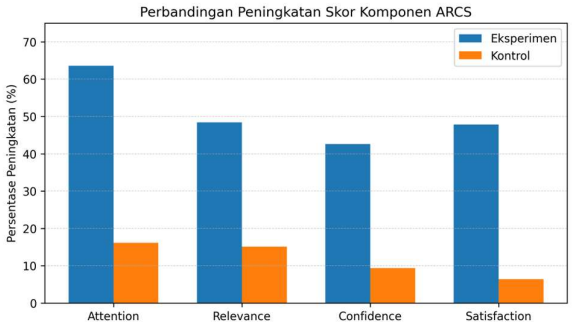
3.4. Increase in Motivation Based on ARCS Components

A further analysis was conducted on the four components of ARCS motivation. The results of the analysis showed that all motivation components in the experimental group experienced a higher increase compared to the control group.

Tabel 4 Peningkatan Skor Per Komponen Motivasi ARCS

Komponen ARCS	Eksperimen Pre→Post	Peningkatan Eksperimen	Kontrol Pre→Post	Peningkatan Kontrol	Selisih
Attention	13,45 → 22,01	8,56 atau 63,6%	13,21 → 15,34	2,13 atau 16,1%	6,43
Relevance	14,23 → 21,12	6,89 atau 48,4%	14,10 → 16,23	2,13 atau 15,1%	4,76
Confidence	15,12 → 21,56	6,44 atau 42,6%	15,34 → 16,78	1,44 atau 9,4%	5,00
Satisfaction	15,32 → 22,65	7,33 atau 47,8%	15,24 → 16,21	0,97 atau 6,4%	6,36

Based on Table 4, the component that experienced the highest increase in the experimental group was Attention, with an increase of 8.56 points or 63.6%. This increase indicates that the PAPEDA warm-up is highly effective in capturing students' attention at the beginning of the lecture. The next component that showed a high increase was Satisfaction, which rose by 7.33 points or 47.8%. Furthermore, the Relevance component increased by 6.89 points or 48.4%, while Confidence increased by 6.44 points or 42.6%.In the control group, the increase in each component appeared much lower. The Attention and Relevance components only increased by 2.13 points each. The Confidence component increased by 1.44 points, while Satisfaction only increased by 0.97 points. The largest difference in improvement between the experimental and control groups was found in the Attention component, with a margin of 6.43 points, followed by the Satisfaction component with a margin of 6.36 points. These results demonstrate that the PAPEDA warm-up is most powerful in arousing students' attention and satisfaction during PESH lectures.The statistical test results for each component also revealed significant differences between the experimental group and the control group. The Attention component yielded a value of $t = 14.23$ with $p < 0.001$. The Relevance component obtained a value of $t = 9.89$ with $p < 0.001$. The Confidence component showed a value of $t = 10.56$ with $p < 0.001$. Meanwhile, the Satisfaction component achieved a value of $t = 12.78$ with $p < 0.001$. Consequently, all components of ARCS motivation experienced significant improvements following the implementation of the PAPEDA warm-up.



Gambar 1 Perbandingan Peningkatan Skor Komponen ARCS Antara Kelompok Eksperimen dan Kontrol

3.5. Results of Observations During Treatment

In addition to the questionnaire data, the observation results during the treatment revealed differences in learning behavior between the experimental group and the control group. Students in the experimental group appeared more enthusiastic, actively engaged in movement, communicated well with their group peers, and showed joyful expressions while participating in the PAPEDA warm-up. The students also seemed more confident in following the game instructions because the activities were conducted in groups and did not emphasize individual physical ability.

Conversely, students in the control group tended to follow the warm-up half-heartedly. Several students appeared unenthusiastic, performed stretching movements lackadaisically, and did not demonstrate strong interaction with their classmates. This difference was also reflected in the attendance rates during the treatment. The experimental group maintained an attendance rate of 98.9%, whereas the control group stood at 90.0%. These observational findings reinforce the quantitative results, demonstrating that the PAPEDA warm-up successfully creates a more active, enjoyable, and motivating atmosphere at the beginning of the lecture.

4. Discussion

4.1. Effectiveness of the PAPEDA Warm-Up on Student Motivation

The results of this study demonstrate that the PAPEDA warm-up is effective in increasing the motivation of PSTE students in PESH lectures. This is evident from the increase in the experimental group's motivation score from 58.12 to 87.34, representing a 50.3% percentage increase. Meanwhile, the control group, which underwent the conventional warm-up, only experienced an increase from 57.89 to 64.56, with a percentage increase of 11.5%. This difference indicates that the PAPEDA warm-up exerts a stronger impact compared to the conventional warm-up.

These findings show that warm-up activities function not only as physical preparation before the core activity but can also serve as an initial strategy to build student learning motivation. A warm-up that is packaged in an active, educational, dynamic, and enjoyable manner is capable of making students better prepared to attend lectures. Conversely, a conventional warm-up that only consists of running, static stretching, and repetitive movements tends to be less capable of arousing student enthusiasm. This aligns with the view that PESH learning needs to be designed with variation so that learners do not merely move but also feel psychologically engaged [1], [2].

The increase in motivation within the experimental group also indicates that PAPEDA is suited to the characteristics of PSTE students. PSTE students are not only participants in PESH lectures but also future primary school teachers. Therefore, the warm-up activities they participate in should ideally provide pedagogical experiences that they can replicate and re-develop when they teach in primary schools. In this context, PAPEDA holds a dual value: increasing student motivation while simultaneously providing an example of a creative and easily applicable motor learning practice.

4.2. PAPEDA as an Active, Educational, Dynamic, and Enjoyable Warm-Up

The success of PAPEDA in increasing student motivation cannot be separated from the four main elements that constitute this model. The first element is **active**, meaning that all students are involved in physical movement from the very beginning of the lecture. In conventional warm-ups, students often merely follow instructions individually and repetitively. Meanwhile, in PAPEDA, students move through group games, resulting in less waiting time and higher participation rates.

The second element is **educational games**. The games in PAPEDA do not only aim to get students moving but also incorporate learning values such as cooperation, communication, introduction to fundamental movement concepts, and simple problem-solving. This element is vital because PSTE students need to understand that PESH does not have to be taught rigidly. Movement activities can be packaged in the form of games that still maintain learning objectives.

The third element is **dynamic**, referring to the variation of games that changes with each meeting. This variation prevents students from becoming easily bored because they do not always perform the same warm-up patterns. Curiosity regarding the upcoming activity can arouse students' attention from the start of the lecture. The fourth element is **enjoyable**, which is apparent through group chants, motivational clapping, group games, and a more cheerful atmosphere. This positive environment makes students more comfortable, particularly those who lack self-confidence in physical activities.

Thus, PAPEDA is not just a variation of a warm-up, but a form of initial learning that integrates physical activity and learning motivation. This model builds a livelier classroom atmosphere prior to entering the core PESH activities.

4.3. Increase in the Attention Component Within the ARCS Model

The results of this study show that the **Attention** component experienced the highest increase in the experimental group, rising by 63.6%. This finding indicates that PAPEDA is highly powerful in capturing students' attention at the beginning of the lecture. The increase in Attention is critical because attention is the gateway to learning engagement. Students who are engaged from the outset tend to be more ready to follow instructions, more focused on activities, and more active during core learning.

The increase in **Attention** occurred because PAPEDA introduces a fresh atmosphere that differs from conventional warm-ups. Games such as fundamental movement relays,

educational cat-and-mouse, chain ball, action cards, and group rope jumping require students not only to perform physical movements but also to think, cooperate, and respond quickly to instructions. Activities of this nature are more engaging than warm-ups consisting solely of running and static stretching. In ARCS theory, attention can be built through elements of novelty, variety, challenge, and active involvement. PAPEDA fulfills these elements because each activity is designed differently and demands direct participation from the students. Thus, the increase in Attention in this study demonstrates that a creative warm-up can serve as an effective strategy to overcome student boredom at the beginning of PESH lectures [3], [4].

4.4. Increase in the Satisfaction Component Within the Experimental Group

In addition to Attention, the **Satisfaction** component also experienced a high increase, rising by 47.8%. This indicates that students were not only interested in participating in PAPEDA but also felt satisfied after engaging in the activities. This satisfaction can emerge because students feel successful in participating in the games, capable of cooperating with their peers, and appreciative of the enjoyable learning environment.

In PESH learning, satisfaction does not always stem from successfully performing difficult movements. It can also arise from positive experiences, a sense of acceptance within a group, the successful completion of collaborative tasks, and a stress-free learning atmosphere. PAPEDA provides space for students to move without excessive pressure. Students are not required to demonstrate individual physical abilities but are guided to participate through group cooperation.

This condition aligns well with the characteristics of the research subjects, who were predominantly female. In classes with diverse motor abilities, warm-up models that overly emphasize physical strength or individual competition can make some students feel awkward. Conversely, PAPEDA emphasizes cooperation, creativity, and enjoyment, making students more comfortable participating in the activities. This explains why student satisfaction in the experimental group increased significantly higher than that in the control group.

4.5. Increase in Student Relevance and Confidence

The **Relevance** component in the experimental group also experienced an increase of 48.4%. This improvement indicates that students recognized a connection between PAPEDA activities and their needs as future primary school teachers. The educational games in PAPEDA can serve as examples of activities that they can later utilize when teaching primary school children. Consequently, students do not merely participate in the warm-up as a lecture obligation, but view the activity as a professional asset.

The **Confidence** component increased by 42.6%. Although its increase was lower than that of Attention, Satisfaction, and Relevance, this result still demonstrates that PAPEDA is capable of building students' self-confidence when participating in PESH activities. This self-confidence is formed because the activities are carried out gradually, in groups, and do not highlight individual mistakes. Students who initially lacked confidence in moving could feel safer because the activities were performed together with their peers.

The relatively lower increase in Confidence compared to the other components can be understood because self-confidence in physical activities requires a longer period to develop. Students with diverse motor skills backgrounds do not necessarily feel immediate confidence within just eight meetings. Therefore, implementing PAPEDA over a longer duration has the potential to yield a greater increase in self-confidence.

4.6. Comparison With Conventional Warm-Ups

The control group, which underwent the conventional warm-up, also experienced an increase in motivation, but the percentage was far lower than that of the experimental group. The 11.5% increase indicates that conventional warm-ups still provide benefits, particularly in establishing physical readiness. However, these benefits are not strong enough to optimize student learning motivation.

Conventional warm-ups tend to be individualistic, repetitive, and lack social experiences. Students merely follow movement instructions without much interaction, variation, or engaging challenges. As a result, the warm-up activity is easily perceived as a mundane routine. This stands in contrast to PAPEDA, which integrates movement, games, cooperation, and an enjoyable atmosphere. This difference in characteristics is what caused the increase in motivation in the experimental group to be much higher than in the control group.

The observational findings also reinforce the quantitative results. Students in the experimental group appeared more enthusiastic, actively communicative, and showed joyful expressions during the activities. Meanwhile, students in the control group tended to follow the warm-up half-heartedly. The attendance rate of the experimental group, which reached 98.9%, also demonstrates that PAPEDA can foster better student engagement compared to conventional warm-ups.

4.7. Research Implications

The findings of this study carry several important implications. Theoretically, this research reinforces the application of the ARCS model in PESH learning, specifically within warm-up activities. Student motivation can be explained through four components: Attention, Relevance, Confidence, and Satisfaction. The finding that Attention and Satisfaction experienced the highest increases suggests that an enjoyable and varied warm-up can be the key to building students' initial motivation.

Practically, this study provides an alternative warm-up model that can be easily implemented by PESH lecturers. PAPEDA does not require expensive facilities as it can utilize

simple equipment such as plastic balls, paper cards, ropes, whistles, or objects available in the surrounding environment. This is crucial for higher education institutions in regions with limited facilities, including the South Sorong area. Through this model, lecturers can create a more active lecture atmosphere without having to depend on comprehensive sports facilities.

For PSTE students, PAPEDA can also serve as an inspiration for designing PESH learning in primary schools. Students can learn that warm-ups do not have to be monotonous but can be developed into enjoyable, educational activities. This supports their readiness as creative, adaptive future teachers who are capable of teaching according to the needs of primary school learners.

4.8. Research Limitations

Although the results indicate that PAPEDA is effective in increasing student motivation, this study has several limitations. First, the research design employed a quasi-experimental approach without full randomization, leaving the possibility of uncontrolled differences in characteristics between the groups. Second, the treatment duration lasted for only eight meetings; thus, it remains unknown whether the increase in motivation can be sustained over the long term. Third, motivation was measured using a self-report questionnaire, meaning that students' responses may have been influenced by subjectivity or social desirability bias. Fourth, the composition of the research subjects was predominantly female, so generalizing the results to student groups with a more balanced gender composition should be done with caution. Therefore, future research is recommended to utilize larger sample sizes, longer intervention periods, and measure other variables such as physical fitness, motor skills, learning outcomes, and motivation retention.

5. Conclusion

Based on the results of the study and discussion, it can be concluded that the PAPEDA warm-up is effective in increasing the motivation of PSTE students in PESH lectures. This effectiveness is evident from the increase in the experimental group's motivation score from 58.12 to 87.34, representing a percentage increase of 50.3%. Meanwhile, the control group, which underwent the conventional warm-up, only experienced an increase from 57.89 to 64.56, with a percentage increase of 11.5%. The statistical test results revealed a significant difference with $p < 0.001$. This finding proves that a warm-up designed to be active, educational, dynamic, and enjoyable is more capable of arousing student motivation compared to a conventional warm-up.

The increase in motivation within the experimental group also occurred across all ARCS components. The component that experienced the highest increase was **Attention** at 63.6%, followed by **Satisfaction** at 47.8%, **Relevance** at 48.4%, and **Confidence** at 42.6%. These results indicate that the PAPEDA warm-up is most powerful in capturing students' attention and building satisfaction at the beginning of the lecture. Through an enjoyable game-based atmosphere, students became more focused, active, confident, and felt more comfortable participating in PESH activities.

The PAPEDA model has also proven to suit the characteristics of PSTE students who possess diverse backgrounds in motor skills. This warm-up does not emphasize individual physical strength, but rather highlights cooperation, creativity, communication, and group involvement. Therefore, PAPEDA can serve as an alternative warm-up that is inclusive, simple, and easy to implement in PESH lectures, particularly in study programs preparing future primary school teachers.

Practically, the results of this study offer recommendations for PESH lecturers to utilize the PAPEDA warm-up as a variation for lecture-opening activities. This model can be applied without requiring expensive equipment, as it can utilize simple objects such as plastic balls, paper cards, ropes, whistles, used bottles as cones, and music from mobile phones. In addition to increasing student motivation, this model can also serve as an example for PSTE students in designing creative and enjoyable PESH learning when they become primary school teachers.

This study has several limitations. First, the research design employed a quasi-experimental approach, which did not involve full randomization of subjects. Second, the treatment duration lasted for only eight meetings; thus, it cannot confirm the long-term sustainability of student motivation. Third, motivation measurement still relied on a self-report questionnaire, leaving the possibility that answers were influenced by students' subjective perceptions. Fourth, the composition of the research subjects was predominantly female, meaning the results need to be retested on student groups with a more balanced gender composition.

Based on these limitations, future research is recommended to test the PAPEDA warm-up with a longer duration, a larger sample size, and a stronger experimental design. Subsequent studies could also explore other variables, such as physical fitness, motor skills, PESH learning outcomes, movement confidence, and student motivation retention. Consequently, the PAPEDA model can be more widely developed as an innovative warm-up in higher education PESH learning.

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