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# Improving learning in physical education: Augmented reality mobile app-based for fundamental motor skill

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## Abstract

The COVID-19 pandemic makes the physical education learning process take place distance learning so that students still have good fundamental motor skills. Interactive media can be used as an alternative to physical education learning. This study aimed to determine the use of interactive Augmented Reality Mobile App-Based media against Fundamental Motor skills 9-10 Years Old School Children. This research uses a quantitative approach, a type of quasi-experimental research, using matching-only. The samples in this study are 74 students of the basic sector aged 9-10 years, data collection for fundamental motor skills using TGMD-2, and data analysis using the t-test. The results showed that 2-tailed sig = 0.000 < 0.05, which explained that interactive media Augmented Reality Mobile App-Based affects fundamental Motor skills 9-10 Years Old School, Children. The study concludes that interactive media Augmented Reality Mobile App-Based can provide an increase in Fundamental Motor Skills in addition to the use of interactive media, Augmented Reality Mobile App-Based can be an alternative teaching media in physical education subjects.

**Keywords:** physical education, augmented reality, fundamental motor skill.

## INTRODUCTION

The emergence of problems in physical education learning at all levels of schools is currently the Covid-19 pandemic which has resulted in students conducting distance learning because, during distance learning, teachers have difficulty controlling and directing the movement patterns of physical activity and sports to the maximum. The impact of covid 19 provides changes to education that are detrimental to children in primary schools, especially on

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health (Hoofman & Secord, 2021), Especially in elementary school (SD) students who need direct assistance from service education teachers during the learning process. These conditions can result in the achievement of physical education learning in elementary schools not running well because physical education can improve motor skills and increase physical activity (Knaus, Lechner, & Reimers, 2020). Considering the findings of the study integrated, it is believed that teaching applied for courses via distance education is inadequate and inefficient. Also, it is possible to state that it may not be appropriate to teach theoretical courses via distance education, except when necessary (Kirbas, 2020), Physical education class participation and additional PA after school hours were both important for perceived health, PA, $VO_{2max}$, and metabolic health in adulthood up to 70 years (Ekblom-Bak, Ekblom, Andersson, Wallin, & Ekblom, 2018).

For this reason, if physical education is hampered, it will impact students' motor skills, including locomotor movement and control of objects. Locomotor motion is a body movement or place-shifting activity that includes running, galloping, skipping, hopping, sliding, and leaping. At the same time, the object of control or manipulation is a motion that can control objects well, including throwing, catching, bouncing, kicking, striking, and rolling (Haywood & Getchell, 2021). The government has mandated the process of learning physical education during the pandemic by regulating the minister of education in the emergency curriculum with distance learning. Physical education lessons can be implemented and have the potential to continue during the current COVID-19 period. PJJ steps can be done by providing lessons through projects such as the use of digital application videos (Mendrofa, 2021), while for physical education learning media used during a pandemic with media WhatsApp media (95.15%), Google Classroom (86.40%), Zoom ( 85.80%) Telegram (79.20%) Learning House (78.60%) Our Desk (78.60%) Youtube (79.20%) Teacher's Room (76.20%) (Suryaningsih, Pujianto, Sutisyana, & Raibowo, 2021).

The results of observations made on physical education teachers in elementary schools stated that during the pandemic, Distance Learning for physical education subjects ran using the WhatsApp application, control distance learning by means of students sending videos when the teacher had given them motion assignments after further studying the teacher stated that basic elementary schools are difficult to translate motion tasks properly so that the movements carried out by students do not run optimally. Based on this fact, one of the efforts so that elementary school students do not have difficulty translating motion tasks during distance learning, it is necessary to have an approach or technological media that can help the gap. Augmented Reality (AR) describes a combination of technologies that enable the real-time mixing of computer-generated content with live video display (Mekni & Lemieux, 2014). AR applications have been applied in various aspects of life, and one of the most is the field of education. The research results show that using AR applications makes elementary school students confident during learning activities and makes them acquire target knowledge, with innovative learning programs and helping low-achieving students improve their learning performance. In general, AR is an application concept that combines the physical world (the real object) with the digital world without changing the shape of the physical object (Saurina, 2016). Object recognition (image) is used to display various information about the object in the form of 3D images and sounds according to the character of the image object in physical education subjects in elementary schools.

The AR application in this study focuses on containing 3D features that contain physical education learning materials in elementary schools containing conceptual 3D images of fundamental motor skills (running, kicking balls, throwing balls, catching balls, swinging, chartwelling, and front roll) strengthened by research results that confirm that the use of AR applications in physical education shows that the use of 3D AR applications is more effective than instructions via video, and the effect is better on more difficult


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motor skills (Chang, Zhang, Huang, Liu, & Sung, 2020). AR-based multimedia in physical education can increase student achievement (Muktiani, Soegiyanto, Siswantoyo, Rahayu, & Hermawan, 2022). AR can be used as a new medium for lazy children to move by combining physical exercise and cognitive learning that includes all knowledge in physical education subjects (Aznar, Caceres, Trujillo, & Romero, 2019).

During the COVID-19 pandemic, which requires students to study distance learning leraning, which will hamper the learning process for physical education, of course, it will have an impact on the fundamental motor skills of elementary school children, with augmented reality interactive media, it is hoped that students will continue to learn motion even though they are doing distance learning. This study tries to test augmented reality interactive media, which contains physical education materials for grade 3 elementary schools to impact fundamental motor skills.

## METHOD

This research uses a quantitative approach, quasi-experimental research methods, using a matching-only design:

| | | | |
|---|---|---|---|
| **M** | T1 | X | T2 |
| **M** | T1 | - | T2 |

**Figure 1.** Research Design (Maksum, 2018)

This study was conducted on basic sector students aged 9-10 years. As many as 74 students with a body mass index of 21.3 kg / $m^2$, normal blood pressure, and normal heart rate voluntarily became research samples with purposive sampling techniques. Characteristic sampling:


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**Table 1.** Characteristic sampling

| Parameter | characteristic |
|---|---|
| age | 9-10 |
| body mass index | 18,5 -22,9 |
| Systolic Blood pressure (mmHg) | 80-120 |
| Diastolic Blood pressure (mmHg) | 50-80 |

All research objects were informed about the research process both orally and in writing before the implementation of the study. The process of using augmented reality media is carried out for one semester or six months of each physical education learning process.

## Research Procedure

1. treatment to the subject

   The treatment was carried out on the experimental group by providing a schedule for using augmented reality media applications to research samples following the schedule for physical education subjects, in using augmented reality media applications, students were guided directly by physical education teachers who had been given a learning syntax using augmented reality media applications, The use of augmented reality media lasted for 35 minutes in the initial session of physical education subjects. After that, practice in the field according to the chosen theme on augmented reality media. In the control group, treatment was carried out in conventional physical education learning or the usual physical education learning process.

2. the subject of the study

   This study's use of augmented reality media applications gradually started by introducing applications to research subjects, downloading smart motor applications on the Playstore, then using augmented reality media with direct guidance by physical education teachers.

3. Surveillance of the sample

   Supervision of the research sample takes place during the research process carried out by physical education teacher research control is only internal control. The control process on the sample occurs if the sample has difficulty using the application. In this case, the educator's function is to ensure the application runs and provide movement corrections when students perform the practice.

4. Program media augmented reality.

   The process of using augmented reality media is carried out for one semester or six months of each physical education learning process. The following is a learning schedule using augmented reality media:

**Table 2**. Schedule using augmented reality media

| Month | Week | Media augmented reality |
|---|---|---|
| **1** | 1-2 | Cartwell, walk, front roll, (plank) |
| | 3-4 | Swing, throw the ball, catch the ball (sit-ups) |
| **2** | 1-2 | Kicking the ball, running, walking (push-ups) |
| | 3-4 | Cartwell, walk, front roll, (plank) |
| **3** | 1-2 | Swing, throw the ball, catch the ball (sit-ups) |
| | 3-4 | Kicking the ball, running, walking (push-ups) |
| **4** | 1-2 | Cartwell, walk, front roll, (plank) |
| | 3-4 | Swing, throw the ball, catch the ball (sit-ups) |
| **5** | 1-2 | Cartwell, walk, front roll, (plank) |
| | 3-4 | Swing, throw the ball, catch the ball (sit-ups) |
| **6** | 1-2 | Cartwell, walk, front roll, (plank) |
| | 3-4 | Kicking the ball, running, walking (push-ups) |

## Data collection

Data collection for fundamental motor skills using the test of Gross Motor Development-2 (TGMD-2) (Ulrich, Soppelsa, & Albaret, 2000), with the following test components:

**Table 2.** TGMD-2 test components

| Test components | |
|---|---|
| Locomotor | Control object |
| Run | Striking a stationary |
| Gallop | Stationary dribble |
| Hop | Catch |
| Leap | Kick |
| Horizontal jump | Overhand Throw |
| Slide | Underhand roll |

Source: (Ulrich et al., 2000)

The data were analyzed with the SPSS statistical program version. IBM analytics 25.0, using t-test (description data, paired test and independent sample test).

## RESULT

### Description of Research Data

The presentation of research data will be analyzed according to their respective groups. The following is a description of the data obtained:

**Table 3.** Data description Pretes-postest fundamental motor skill

| Group | | N | Minimum | Maximum | Mean | SD | Variance |
|---|---|---|---|---|---|---|---|
| **Experiment** | Pretest | 37 | 75 | 99 | 85.05 | 6.782 | 45.997 |
| | Postest | 37 | 100 | 115 | 108.97 | 6.090 | 37.083 |
| **Control** | Pretest | 37 | 80 | 105 | 87.46 | 10.181 | 103.644 |
| | Postest | 37 | 81 | 106 | 91.30 | 9.079 | 82.437 |

Deviation data and the data variants that appear. Based on the data in the table, it is known that the pretest data in the experiment group minimum value is 75, the maximum value is 99, the mean is 85.05 std, the deviation is 6,783, and the variant is 56,997 while the post-test data minimum value is 100, the maximum value is 115, mean, 108.97 std, a deviation is 6,090 and variant 37.83, for pretest the control group has a minimum value of 80, maximum value 105, mean, 85.46 std, deviation 10.181 and variant 103.644, the value on post-test minimum value 81, maximum value 106, mean, 91.30 std, deviation 9.079 and variant 82.437. Using the data above, it can be seen

that there is a change in the average value between the pretest and post-test of the two groups, which means that there is a change in the data that indicates a change in the fundamental motor skill ability of each group. So are the changes in the maximum and minimum values followed by the SD.

**Paired t-test**

To determine the effect of augmented reality applications on motor skill fundamentals, data from the paired t-test were obtained, and the following data from the analysis of the experimental group and control group. Whereas in the control group, treatment was carried out in the form of conventional physical education learning or the usual physical education learning process:

**Table 4.** Data analysis of experimental groups and control groups

| Group | | Mean | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|
| **Experiment** | Pretest-Postest | -23.919 | -18.974 | 36 | .000 |
| **Control** | Pretest-Postest | -3.838 | -3.729 | 36 | .001 |

Based on the table above shows that the 2-tailed sig = 0.000 < 0.05, which means that the augmented reality mobile app-based of smart motor group experiment affects the fundamental motor skill, while the control group shows that the 2-tailed sig = 0.001 < 0.05, which means the group also provides an increase in fundamental motor skills, to see the difference in the increase in the nature of the experimental group and the control group can be seen in the independent analysis of the sample t-test below:

**Table 5.** Differences in improvement in each group

| | | F | Sig. | T | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| **Fundamental Motor Skill** | Equal variances assumed | 3.828 | .054 | 12.339 | 72 | .000 |

The table above shows that the 2-tailed sig = 0.000 < 0.05, which means that the augmented reality mobile app-based smart motor group has differences from the control group.

## DISCUSSION

Augmented Reality (AR) describes a combination of technologies that enable the real-time mixing of computer-generated content with live video display (Mekni & Lemieux, 2014). Several different types of AR devices and applications are discussed at length, and an in-depth analysis is done of several studies that have implemented AR technology in an educational setting (Antonioli, Blake, & Sparks, 2014).

In the world of AR, technology education is accommodating for students in the learning process of outcomes, research states that AR technology shows good potential in providing students with more active, effective and meaningful learning processes (Alkhattabi, 2017). In addition, the use of AR in education can encourage the improvement of student learning achievement (Akçayır & Akçayır, 2017). Although augmented reality offers new learning opportunities, AR also creates new challenges for educators (Wu, Lee, Chang, & Liang, 2013).

AR technology in education has been used in several subjects, including augmented reality as an android-based interactive learning tool for elementary school students to deliver material about the solar system. To display virtual objects, a marker is used for each object. Markers are made in book-like sheets with a front cover, contents, and back cover. The image in the marker is in the form of a printed three-dimensional object so that when the application is directed at the marker, the three-dimensional object seems out of the marker image (Prasetyo, 2014).

AR is recommended as a tool in physics subjects because it can increase students' positive emotions in base learning projects (Fidan & Tuncel, 2019). In addition (Dhiyatmika, Putra, & Mandenni, 2015) uses Augmented Reality to introduce animals to kindergarten students. Markers with animal images printed on paper are made to appeal to kindergarten students. When the application is directed above the marker, the three-dimensional image of the animal will automatically appear to come out of the

image, which is accompanied by an animation of the animal's movement. Through this learning media, it is hoped that kindergarten students can be more enthusiastic about learning about various animals.

Teaching methods through AR technology effectively teach students physical education subjects (Moreno-Guerrero, Alonso García, Ramos Navas-Parejo, Campos-Soto, & Gómez García, 2020). In addition to that also with AR technology provides an opportunity to build educational activities, based on the intervention of parents with the child, oriented to the interests and abilities of each child, the development of curiosity, cognitive motivation and educational energy; development of imagination, creative initiative, including speech, the ability to select materials, types of work, participants of general activities, promotion of conditions for parents to participate in joint learning activities (Midak, Kravets, Kuzyshyn, Pahomov, & Lutsyshyn, 2020) AR can be used as a new medium for children who are lazy to move by combining physical exercise and cognitive learning that includes all knowledge in physical education subjects (Aznar et al., 2019).

This study has limitations on the school system which does not all allow carrying smart phones in the post-covid-19 pandemic and is still limited to learning elementary school physical education in grade 3. For further research, it is possible to conduct similar research with different ones and develop augmented reality interactive media. Mobile App-Base for all subject matter at the elementary school level, considering innovation and technology development in physical education subjects.

## CONCLUSION

The results showed that using interactive media Augmented Reality Mobile App-Based can improve children's fundamental motor skills of 9 -10-year-old school children. Further research is expected to be able to test more specifically the use of interactive media Augmented Reality Mobile App-Based on locomotor motion and control objects.

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