

The influence of Android-based gymnastics learning media on cartwheel skills

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Abstract

Cartwheels are one of the gymnastics skills in Physical Education (PE) teaching that must be mastered by junior high school students. In their teaching, PE teachers must be able to create innovative and interactive learning, thereby generating student motivation to master this skill. This study aims to analyze the effect of using Android-based gymnastics learning media on cartwheel skills in junior high school students. This research is an application of one of the Android-assisted exercise materials for junior high school students developed from Handayani et al study (Handayani et al., 2023), where one of the gymnastics materials in the application is cartwheel skills which will be reported in this research. This research was a pre-experiment with a one group pretest-posttest design, involving 63 junior high school students in one of the provinces in Indonesia. Participants were seventh and eighth grade male students taking combined PE classes, and aged 12-13 years. The procedure in this research is collecting pretest data for cartwheel skills, using Android-based exercise media for cartwheel material by students, and collecting post-test data. The duration of the meeting was 4 weeks, and the instrument used was a cartwheel skills test, which consisted of initial, main and final phases. Then, the data was analyzed using paired sample t-test. The results of the research show that there are differences in the average of each phase and all phases of cartwheel skills, with pretest data being 62.51 (less) and post-test being 70.13 (enough). Then, the results of the paired sample t-test showed that there was an influence of the use of Android-based gymnastics learning media on cartwheel skills ($P < 0.05$). In conclusion, junior high school students' cartwheel skills can be improved by using this learning media, so it is hoped that it can overcome limitations in gymnastics learning, whether used by PE teachers, junior high school students, and gymnastics practitioners. Future research is needed involving a wider range of participants, female gender, and comparison groups.

Keywords: learning media, gymnastics, artistic, Android, cartwheels, Physical Education

Introduction

Gymnastics is one of the core lessons in PE for junior high school students (Handayani et al., 2023), and extracurricular activities in educational programs around the world (Pajek et al., 2010). This sport involves the musculoskeletal system which is distributed through the elbow and wrist joints while the body is supported by the upper extremities (Farana et al., 2014, 2017). Alternating support between the upper and lower extremities, where the upper extremities are often used to support weights in gymnastics exercises (DiFiori et al., 2006). Additionally, the choice of technique may impact injury and is an important area of research (Farana et al., 2014, 2017).

Artistic, rhythmic and acrobatic gymnastics require physical abilities of strength and flexibility (Ávalos-Ramos & Vega-Ramírez, 2020). In this instance, stability abilities are crucial for individual development (locomotor skills and object control), and the gymnastic activities that are frequently undertaken by boys and girls help to improve postural control in the bipedal position (Rudd et al., 2015). Rudd et al. (2017) reported that implementing an 8-week gymnastics program on students provided significant results on coordination, basic movement skills and self-concept compared to students who were not involved in gymnastics instruction. The significant gains in abdominal strength, flexibility, cardiovascular fitness, and strength have also been documented in children and adolescents following a 12-week exercise regimen (Trajković et al., 2016). The selection of material to be developed, approaches, and interaction strategies all influence how well students learn gymnastics skills in PE (Asún et al., 2020; Kok et al., 2020).

Gymnasts' skills when performing stunts are generally assessed by PE teachers, coaches, or judges based on the aesthetics of the movements. For PE teachers and certain coaches, this presents a problem because they might not have the requisite experience in every sport (Kong, 2016), or inexperience in a particular sport (Kojima et al., 2021). Problems that often arise include inadequate student preparation and experience, as well

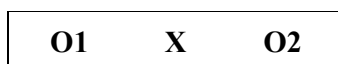
as a lack of training for PE teachers to teach gymnastics, which prevents students from acquiring the necessary abilities (Handayani et al., 2023).

In essence, secondary school PE instruction focuses on the growth and proficiency of athletes (Proios, 2019), including cartwheel skills in gymnastics. A cartwheel movement that is done well and correctly meets the criteria for straightness (Hartig & Buchmann, 2004), which is defined as the distance from the center line or straight line parallel to the gymnastics mat (starting from the y coordinate of the first leg) (Hennig et al., 2017). Study from Delaš et al. (2008), shows the performance of cartwheels and flexibility are positively correlated. This means that educators need to be able to design creative, interactive lessons, including using technology into their instruction (Alnedral et al., 2023; Handayani et al., 2023), and how they make use of different apps that can create creative and engaging educational materials, including those supported by Android (Doloksaribu & Triwiyono, 2020).

Learning media is anything that is used to stimulate students' thoughts, attention, feelings and willingness to encourage an effective and efficient learning process in the learning process. Android-based learning media presents material effectively, efficiently and more interestingly to help students learn movements in gymnastics (Handayani et al., 2023). The advantages of Android have been the subject of several earlier research. For example, Android-assisted exercise learning media have been designed and developed to enhance front straddle roll abilities (Handayani et al., 2022), and android-assisted handstand skills (Handayani et al., 2023). Study from Le Naour et al. (2019), which evaluated the effectiveness of several visual information types to enhance the performance of deep roundoff movement exercises. A total 32 participants between the ages of 20 and 26 participated in the study, which compared two forms of 3D feedback to 3D visualizations that solely displayed expert motions (observations) and more conventional video observations. Then, study from Potdevin et al. (2018), the use of video feedback in novice children learning gymnastics skills, and how it impacts motor skills, self-assessment abilities and motivation. This study was carried out for 5 weeks in a gymnastics learning program, which consisted of an experimental and control group. Previous studies clearly report the benefits of using technology when integrated with pedagogical approaches in PE (Roure et al., 2019). Unfortunately, teaching gymnastics with the help of Android on cartwheel skills to junior high school students is still rarely done. Therefore, this study aims to analyze the influence of Android-based gymnastics learning media on cartwheel skills in junior high school students.

Materials & Methods

This research was a pre-experiment with a one group pretest-posttest design (Figure 1). This research involved 63 junior high school students in one province in Indonesia. Participants were seventh and eighth grade male students taking combined PE classes, and aged 12-13 years.



Note- O1 is pretest, X is treatment, and O2 is post-test

Figure 1. Experimental design

This research is an application of one of the Android-assisted exercise materials for junior high school students that has been developed by Handayani et al. (2023), where previous studies have focused on handstand skills. Meanwhile, other exercise material in the application is cartwheel skills which will be reported in this research. The learning media developed has been tested as feasible with an average *V* index of 0.87 (high) and *ICC* of 0.88 (very high). The steps in this study were to: (a) gather pretest data using a cartwheel skill test prior to employing Android-based gymnastics learning media; and (b) treat the students by giving them access to Android-based exercise learning media while they were studying. This treatment uses Android-based exercise learning media on cartwheel material by students, with a meeting duration of 4 weeks; and (c) gather post-test data by carrying out cartwheel skills tests. The instrument used in this research is a cartwheel skill test, which consists of initial, main and final phases. The classification of cartwheel skills is a score of $0 \leq N \leq 29$ (very less), $30 \leq N \leq 64$ (less), $65 \leq N \leq 79$ (enough), $80 \leq N \leq 89$ (good), and $90 \leq N \leq 100$ (very good). Then, the data was analyzed using paired sample t-test. Normality testing uses the Shapiro-Wilk test and homogeneity uses the Levene test. This data analysis uses the help of the IBM SPSS version 26 statistical program.

Results

Table 1 presents a descriptive examination of students' cartwheel skill data following their use of Android-based gymnastics instructional materials. The average difference of all phases shows that the cartwheel skill in the pretest data was 62.51 (less) and the post-test was 70.13 (enough). The average differences from each phase for pretest and post-test data are presented in Figure 1. Additionally, tests for homogeneity and normality reveal that the data is homogeneously and normally distributed ($P > 0.05$) (Table 2). Subsequently, the paired sample t-test findings indicated that using gymnastics learning material based on Android had an impact on cartwheel skills ($P < 0.05$) (Table 3).

Table 1. Descriptive analysis of pretest and post-test data for cartwheel skills

Data	N	Phase	Minimum	Maximum	Per phase	All phases	Category	Difference
Pretest	63	Initial	48.00	72.50	61.24 ± 5.83	62.51 ± 5.32	Less	7.62
		Main	43.00	70.00	59.22 ± 5.69			
		Final	57.00	78.00	67.83 ± 5.04			
Post-test	63	Initial	55.12	83.00	67.92 ± 7.51	70.13 ± 6.96	Enough	
		Main	54.00	82.00	68.23 ± 7.42			
		Final	63.00	84.00	76.82 ± 7.12			

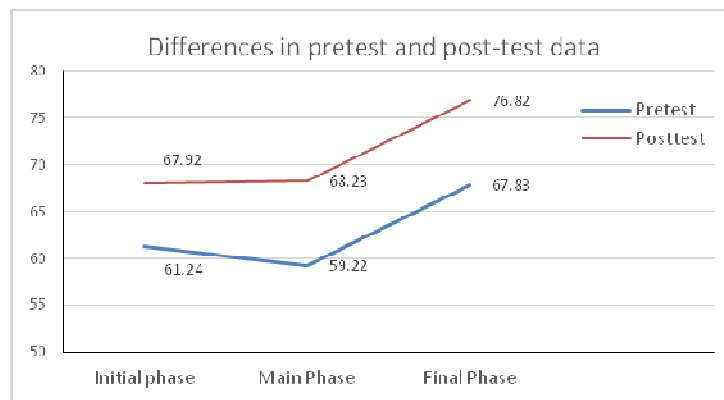


Figure 2. Difference in average cartwheel skills between pretest and post-test data

Table 2. Summary of data analysis requirements

Normality		Homogeneity	
Data	P*	Data	P*
Pretest	0.752	Pretest-post-test	0.247
Post-test	0.623		

*Data is normally distributed and homogeneous ($F > 0.05$).

Table 3. Summary of paired sample t-test

Data	df	R(N=63)	P*	M ± SD	SEM	T	P (2-tailed)*
Pretest-post-test	63	0.765	0.000	7.26 ± 3.29	0.470	15.36	0.000

*The difference is significant ($P < 0.05$).

Discussion

This study reports that there are differences in averages for each phase and all phases of cartwheel skills, both in pretest and post-test data. The results of the paired sample t-test also showed that there was an influence of the use of Android-based gymnastics learning media on cartwheel skills ($P < 0.05$). Previous studies reported that technological assistance in PE can increase students' ability and motivation to learn movement skills in sports, and help PE teachers to create effective and efficient learning (Krause & Sanchez, 2014; Wang & An, 2017).

Mobile devices are very suitable for use in sports teaching, because they can be used inside and outside the field/room, precisely can be used anytime and anywhere (Chambers et al., 2017). The use of mobile devices in PE learning related to physical activity will help students realize their usefulness in improving sports skills. Study from Cummiskey (2011) reported, PE teachers can utilize various applications on mobile devices to improve students' abilities in terms of physical activity. In addition, technological assistance in sports performance is also frequently used and proven to be effective for improving better training (Kokarev et al., 2023; Lisenchuk et al., 2023; Oh et al., 2019). In other words, one of the basic considerations for developing Android-based teaching media is flexibility in accessing information, anytime and anywhere.

This research has been carried out as well as possible, but there are several limitations that need to be reported. This research is a test of one of the Android-assisted exercise materials that has been developed by Handayani et al. (2023), where the product has undergone effectiveness testing in the form of Android-based instructional materials. The results of this study are presented, but the usefulness of the content for cartwheeling in learning media has not been examined. Future research should focus on female participants and a larger sample size than the 63 male junior high school students in one Indonesian province that participated in this study. In addition, in order to evaluate the efficacy of Android-assisted gymnastics learning media with cartwheel skills material, a comparison group is also required.

Conclusions

The research's findings suggest that junior high school students can use Android-based gymnastics learning resources in their PE lessons to get better at cartwheels. The average difference of all phases shows that the cartwheel skill in the pretest data was 62.51 (less) and the post-test was 70.13 (enough). Then, the results of the paired sample t-test showed that there was an influence of the use of Android-based gymnastics learning media on cartwheel skills ($P < 0.05$). Thus, by employing this learning resource, junior high school students cartwheel abilities can be enhanced. The findings of this study should aid in the improvement of cartwheel abilities for junior high school student, gymnastics instructors, and gymnasts. Future studies must include larger participant numbers, female gender representation, and comparison groups.

Conflict of interest- The authors declare no potential conflicts of interest

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