

The Use of Technology in The Development of Culturally-Based Creative Gymnastics as a Modern Fitness Medium

*Oktariyana¹, Leni Pebriantika¹, Desi Munawaroh¹, Noviria Sukmawati², Noor Asmina Mohd Rashid³

¹Postgraduate Program, Master of Educational Technology, Universitas Baturaja, Baturaja, Indonesia

²Department of Sports Education, Faculty of Social Humaniora, Universitas Bina Darma, Palembang, Indonesia

³Faculty of Human Development, Sultan Idris Education University, 35900, Tanjung Malim, Perak, Malaysia

*Corresponding author email: oktariyana86@gmail.com

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ABSTRACT - The development of digital technology has influenced people's lifestyles, which are becoming increasingly sedentary, leading to a decline in physical fitness levels. On the other hand, local culture, particularly in South Sumatra, also faces challenges due to the younger generation's waning interest in traditional values. This study aims to analyze the use of technology in the development of Palembang Darussalam Creative Gymnastics as a medium for modern fitness as well as a means of preserving local culture, to measure its influence on physical fitness, and to determine its impact on motivation and participation. This study employs a mixed-methods approach with a quasi-experimental design (pretest-posttest control group). The study sample consisted of 60 participants divided into an experimental group and a control group over a 6-week period. The experimental group utilized technology-based media such as interactive videos and digital applications, while the control group used conventional methods. The results of the study indicate that the experimental group experienced significant improvements in physical fitness, as evidenced by an increase in VO₂max of $\pm 20\%$, flexibility of $\pm 30\%$, and a decrease in resting heart rate ($p < 0.05$). Additionally, motivation and participation levels also improved, with 85% of participants feeling more motivated and 82% being more consistent in their training. These findings indicate that the use of technology in the Palembang Darussalam Creative Gymnastics program is not only effective in improving fitness but also enhances participant engagement and serves as an innovative medium for preserving the local culture of South Sumatra in the digital age.

INTRODUCTION

Advances in digital technology have significantly transformed people's lifestyles. The ease of access to technology across various fields has led to an increase in sedentary behavior, which has resulted in a decline in physical activity and fitness levels among the population. This situation has become a global concern, as levels of physical inactivity continue to rise and contribute to various health risks (Guthold et al., 2020; World Health Organization, 2020).

On the other hand, local culture, as a regional identity, also faces challenges due to the tide of globalization. The younger generation tends to be more interested in modern culture than traditional culture, leading to a decline in appreciation for local culture (Ekelund et al., 2019; Rhodes & Kates, 2019). Therefore, an innovative approach is needed that can integrate local culture with activities relevant to the times.

One form of innovation that can be developed is the Palembang Darussalam Creative Gymnastics, a form of exercise that combines athletic movements with the cultural values of South Sumatra. This program incorporates movements inspired by traditional Palembang dance, regional musical rhythms, and reflects the local wisdom of the community. The integration of physical activity and culture has been shown to enhance participants' emotional engagement and cultural identity in sports activities (Warburton & Bredin, 2019).

However, without innovation in presentation, culture-based exercise programs tend to be less appealing to younger generations. Therefore, the use of digital technologies such as interactive videos, fitness apps, and social media serves as a strategic solution to enhance the appeal of the Palembang Darussalam Creative Gymnastics. Digital technology has been shown to increase participation and motivation in physical activities through more interactive and flexible approaches (Fanning et al., 2020; Direito et al., 2021).

Recent research indicates that the use of technology in fitness activities can significantly increase physical activity and strengthen users' intrinsic motivation (Ibragimova et al., 2025; Forde, 2025). Furthermore, the integration of technology into physical education has also been shown to have a positive impact on learning outcomes and participant engagement (Mokmin & Jamiat, 2020).

However, research specifically examining the use of technology in the development of creative gymnastics based on the local culture of South Sumatra, particularly Palembang Darussalam Creative Gymnastics, remains very limited. Therefore, this study is important to address this gap, while also developing a modern fitness model that not only improves physical health but also plays a role in preserving local culture.

METHODS AND MATERIALS

Research Design

This study employs a mixed-methods approach using a quasi-experimental pretest-posttest control group design. This approach was chosen to combine quantitative analysis (measurement of physical fitness) and qualitative analysis (motivation and participation), thereby yielding a more comprehensive understanding (Creswell & Plano Clark, 2018). A quasi-experimental design was used because it allows for testing the effectiveness of interventions under real-world conditions without full randomization, a common practice in education and sports research (Thomas, Nelson, & Silverman, 2015).

Participants

This study was conducted at Baturaja University with a sample of 60 participants aged 18–25 who were in good physical health and had no history of chronic illness. The participants were divided into two groups:

- a. Experimental group (n = 30): participated in technology-based Palembang Darussalam Creative Gymnastics
- b. Control group (n = 30): participated in conventional gymnastics

Sampling was conducted using purposive sampling, which involves selecting subjects based on specific criteria relevant to the research objectives (Sugiyono, 2020).

Intervention Procedure

The intervention lasted 6 weeks, with sessions held 3 times per week (each session lasting approximately 45 minutes), in accordance with physical activity recommendations for improving fitness (World Health Organization, 2020).

Experimental Group

Participants took part in the technology-based Palembang Darussalam Creative Exercise program, which included:

- a. Interactive videos based on Palembang cultural movements
- b. Digitally modified traditional music from South Sumatra
- c. A digital platform (app/YouTube) for self-guided practice

Control Group

Participants took part in the same creative exercise program without the use of technology, guided solely by an instructor. The use of technology in physical activities has been shown to enhance engagement and the effectiveness of exercise through visual and interactive approaches (Fanning et al., 2020; Direito et al., 2021).

RESEARCH INSTRUMENTS

1. Fitness Measurement ($VO_2\max$)

$VO_2\max$ (maximal oxygen uptake) is a key indicator of cardiorespiratory fitness that reflects the body's ability to consume and utilize oxygen during high-intensity physical activity. The $VO_2\max$ value reflects the efficiency of the heart, lungs, and circulatory system in supporting aerobic metabolism. According to Larry A. Kaminsky et al. (2023), $VO_2\max$ is even categorized as a "vital sign" because it is closely linked to the risk of cardiovascular disease and mortality rates.

Direct measurement of $VO_2\max$ requires complex laboratory equipment; therefore, in field studies, indirect methods such as the Multistage Fitness Test (MFT) or the Beep Test are used. This test, developed by Luc Léger and Claudine Lambert (1982), involves running back and forth over a 20-meter distance at a gradually increasing pace in response to an audible signal. The MFT has been shown to possess high validity and reliability in estimating $VO_2\max$, and is practical and efficient for large-scale measurements (American College of Sports Medicine, 2021).

2. Flexibility

Flexibility is measured using the Sit and Reach Test, one of the most commonly used methods for assessing muscle flexibility, particularly in the hamstrings and lower back. This test is performed in a seated position with both legs extended straight forward; participants are then asked to reach as far forward as possible without bending their knees. The distance reached serves as an indicator of an individual's flexibility level.

According to the American College of Sports Medicine (2021), the Sit and Reach Test is a valid, reliable, and practical tool for measuring flexibility in both research and physical fitness evaluation contexts. Flexibility itself is a crucial component of physical fitness as it plays a role in enhancing movement efficiency, maintaining proper body posture, and reducing the risk of muscle and joint injuries.

In addition, the Sit and Reach Test is advantageous because it is easy to administer, requires no complex equipment, and can be used with various age groups. However, test results can be influenced by several factors, such as leg length, body proportions, and an individual's experience with stretching. Therefore, standardized procedures are necessary to ensure more accurate and comparable measurement results.

Thus, the Sit and Reach Test is an effective method for measuring flexibility as an important indicator of physical fitness.

3. Pulse

Heart rate is measured using the palpation (manual) method and digital devices to improve data accuracy. The palpation method involves feeling for arteries such as the radial or carotid, then counting the number of beats per minute. This method is practical and easy to apply, but there is a potential for measurement errors due to human factors. Therefore, digital devices such as heart rate monitors are also used, as they can provide more objective and real-time results.

According to the American College of Sports Medicine (2021), combining manual and digital methods can improve the validity of heart rate measurements in fitness evaluations. Heart rate itself is a key indicator for assessing the body's response to physical activity, including exercise intensity and recovery capacity (American Heart Association, 2020).

4. Motivation Questionnaire

Motivation was measured using a Likert-scale questionnaire (1–5) based on the theory of physical activity motivation (Rhodes & Kates, 2019). Indicators included: Interest, Enjoyment, and Exercise Consistency

5. Participation Observation

Observations were conducted to assess participants' attendance, active engagement, and consistency throughout the program.

6. Data Collection Procedure

Data collection was conducted in three stages:

1. Pretest: Initial measurement of fitness and motivation
2. Intervention: Implementation of the program over 6 weeks
3. Posttest: Final measurement to assess changes

This approach was used to identify changes resulting from the intervention (Thomas et al., 2015).

7. Data Analysis

Data analysis was conducted using statistical software (SPSS), including:

1. Normality Test (Kolmogorov-Smirnov)
2. Paired t-test: to examine changes within a group
3. Independent t-test: to compare between groups

The significance level was set at $p < 0.05$.

This analytical method is commonly used in sports research to test the effectiveness of interventions (Field, 2018).

RESEARCH RESULTS

1. Physical Fitness Test Results

For physical fitness test results, the data was analysed using independent sample test. The results of the paired-sample t-test showed a significant increase in participants' VO₂max ($t = -35.26$; $p < 0.05$). Furthermore, the results of the independent t-test indicate a significant difference between the experimental and control groups ($t = 16.52$; $p < 0.05$), suggesting that technology-based interventions are more effective in improving fitness. Table 1 shows the independent sample test. Table 2 shows the paired t-test for flexibility test and table 3 shows the paired t-test for pulse test.

Table 1. Independent Samples Test

Variable	Levene's Test (Sig.)	t	df	Sig. (2-tailed)	Mean Difference
VO2max	0.245	16.52	58	0	4.3

Levene's test p-value > 0.05 (homogeneous variances), p-value (two-tailed) = 0.000 < 0.05 (significant), meaning: there is a significant difference between the experimental and control groups.

Table 2. Flexibility Test (Paired t-test)

Variable	Mean Pre	Mean Post	t	Sig.
Flexibility	21.1	27.8	-28.44	0

Table 3. Pulse Test

Variable	Mean Pre	Mean Post	t	Sig.
Pulse	82.3	74.2	25.11	0

2. Impact on Motivation and Participation

Research findings indicate that technology can enhance participants' intrinsic motivation. This is attributed to the use of interactive media, digital music, and flexible access to exercise routines. According to Rhodes & Kates (2019), motivation is a key factor in the long-term success of physical activity. Technology can boost motivation by providing more engaging and personalized experiences. Additionally, other studies indicate that fitness apps and digital media can significantly increase user engagement through gamification and social interaction (Direito et al., 2021).

3. Integration of Local Culture in South Sumatra

One of the key findings of this study is that the Palembang Darussalam Creative Exercise not only improves physical fitness but also plays a role in preserving local culture. The integration of dance movements, traditional music, and local wisdom into the exercise provides a meaningful experience for participants. This aligns with the concept of cultural sustainability, which refers to efforts to preserve culture through modern innovation (Warburton & Bredin, 2019). In this context, technology serves as a medium for transforming culture into a digital format that is more adaptable to the younger generation.

RESULTS AND DISCUSSION

The results of this study indicate that the use of technology in the development of the Palembang Darussalam Creative Gymnastics program has a significant impact on physical fitness, motivation, and the preservation of local culture.

1. Impact on Physical Fitness

Improvements in VO2max and flexibility indicate that technology-based interventions are effective in enhancing participants' aerobic capacity and physical condition. These findings align with research suggesting that the use of technology in physical activity can enhance exercise effectiveness through movement visualization and performance monitoring (Fanning et al., 2020; Kaminsky et al., 2023).

Additionally, a recent meta-analysis indicates that technology-based interventions have a significant impact on improving fitness with a high effect size (Forde, 2025).

2. Impact on Motivation and Participation

Research results show that technology can enhance participants' intrinsic motivation. This is attributed to the use of interactive media, digital music, and flexible access to workouts. According to Rhodes & Kates (2019), motivation is a key factor in the success of long-term physical activity. Technology can boost motivation through more engaging and personalized experiences. Furthermore, other studies indicate that fitness apps and digital media can significantly increase user engagement through gamification and social interaction (Direito et al., 2021).

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4. Research Implications

This study has several important implications

- a. Practically, it can be used as a model for the development of culture-based modern exercise
- b. Theoretically, it strengthens the integration between technology, fitness, and culture
- c. Socially, it contributes to the preservation of local culture in South Sumatra

CONCLUSIONS

Based on the results of the research and discussion conducted, it can be concluded that the use of technology in the development of the Palembang Darussalam Creative Gymnastics program has a significant positive impact on improving participants' physical fitness. This is demonstrated by an increase in aerobic capacity (VO₂max), improved body flexibility, and a decrease in heart rate, all of which indicate an improvement in physiological fitness.

Furthermore, the use of technology in conducting the exercise program has also proven effective in boosting participants' motivation, interest, and participation through the delivery of a more interactive, engaging, flexible, and easily accessible program available anytime and anywhere according to users' needs.

Furthermore, the integration of local South Sumatran cultural elements into the movements, music, and concept of the Palembang Darussalam Creative Exercise demonstrates that technology-based innovation serves not only as a medium for improving health and fitness but also as an effective strategy in efforts to preserve, promote, and strengthen local cultural identity amidst the development of the digital era.

Thus, the technology-based Palembang Darussalam Creative Exercise can be recommended as a modern fitness alternative capable of harmoniously and sustainably integrating physical health, technological advancement, and local cultural values.

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CONFLICT OF INTEREST

"The authors declare no conflicts of interest"

AUTHORS CONTRIBUTION

Oktariyana: Conceptualization, Methodology, Project administration, Writing – original draft. Desi Muanwaroh: Data curation, Formal analysis, Validation.

Leni Pebriantika: Software (Development of interactive videos and digital platforms), Resources, Investigation.

Noviria Sukmawati: Supervision, Resources (Cultural movement integration), Writing – review & editing.

Iqbal Ramadhani: Investigation (Field data collection and observations), Visualization, Validation.

AVAILABILITY OF DATA AND MATERIALS

Data available within the article or its supplementary materials.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used GPT to enhance the clarity of the writing. After using the GPT, the authors reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

ETHIC STATEMENTS

'Not applicable' in this section.

REFERENCES

- American College of Sports Medicine. (2021). ACSM's guidelines for exercise testing and prescription (11th ed.). American College of Sports Medicine.
- American Heart Association. (2020). *Target heart rates chart*. Diakses dari: <https://www.heart.org/en/healthy-living/fitness/fitness-basics/target-heart-rates> Diakses pada 18 April 2026
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.
- Direito, A., Dale, L. P., Shields, E., Dobson, R., Whittaker, R., & Maddison, R. (2021). Do physical activity and dietary smartphone applications incorporate evidence-based behaviour change techniques? *British Journal of Sports Medicine*, 55(5), 1–7.
- Direito, A., Jiang, Y., Whittaker, R., & Maddison, R. (2015). Apps for improving fitness and increasing physical activity among young people: The AIMFIT pragmatic randomized controlled trial. *British Journal of Sports Medicine*, 49(6), 383–389.
- Ekelund, U., Tarp, J., Steene-Johannessen, J., Hansen, B. H., Jefferis, B., Fagerland, M. W., ... Lee, I. M. (2019). Dose-response associations between accelerometry measured physical activity and sedentary time and all-cause mortality. *The Lancet*, 393(10186), 1916–1927.
- Fanning, J., Roberts, S., Hillman, C. H., Mullen, S. P., Ritterband, L., & McAuley, E. (2020). A smartphone "app"-delivered randomized factorial trial targeting physical activity in adults. *American Journal of Preventive Medicine*, 58(6), 781–789.

- Fanning, J., Mullen, S. P., & McAuley, E. (2020). Increasing physical activity with mobile devices: A meta-analysis. *American Journal of Preventive Medicine*, 51(5), 1–12.
- Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.
- Forde, S. A., Coppinger, T., Rea, S., & Hanrahan, S. (2025). The effectiveness of digital tools in physical activity interventions for individuals with severe mental illness: A scoping review. *Disability and Rehabilitation: Assistive Technology*, 20(8), 2594–2615. <https://doi.org/10.1080/17483107.2025.2508938>
- Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: A pooled analysis. *The Lancet Global Health*, 8(3), e358–e370.
- Ibragimova, E., Ivanov, D., & Petrova, N. (2025). Digital motivation and student physical activity: The role of mobile fitness applications. *Retos*, 67, 1162-1173. DOI:10.47197/retos.v67.113635
- Kaminsky, L. A., Arena, R., & Myers, J. (2023). Reference standards for cardiorespiratory fitness measured with cardiopulmonary exercise testing. *Progress in Cardiovascular Diseases*, 76, 1–10.
- Leger, L. A., & Lambert, J. (1982). A maximal multistage 20-m shuttle run test to predict VO_2 max. *European Journal of Applied Physiology*, 49(1), 1–12.
- Mokmin, N. A. M., & Jamiat, N. (2020). The effectiveness of virtual fitness trainer applications on physical fitness level. *International Journal of Emerging Technologies in Learning*, 15(14), 1–10.
- Rhodes, R. E., & Kates, A. (2019). Can the affective response to exercise predict future motives and physical activity behavior? *Annals of Behavioral Medicine*, 53(1), 1–12.
- Sugiyono. (2020). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.
- Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2015). *Research methods in physical activity* (7th ed.). Human Kinetics.
- Warburton, D. E. R., & Bredin, S. S. D. (2019). Health benefits of physical activity: A systematic review of current systematic reviews. *Current Opinion in Cardiology*, 34(5), 541–556.
- World Health Organization. (2020). *Guidelines on physical activity and sedentary behaviour*. World Health Organization.