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Game-based rhythmic gymnastics exercise models to develop gross motor skills for primary school students

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ABSTRACT

This research aims to develop game-based rhythmic gymnastics exercise models for primary school students, who have rhythmic gymnastics as a compulsory program in their curriculum. The sequential mixed method was employed to evaluate the exercise model. The data were analyzed using thematic qualitative analysis and expert judgment, and the latter was designed to incorporate quantitative data. The experts in this research included 7 experts who are either academic instructors or professionals. Delphi method was used to collect the data and a Likert-scale questionnaire with a range of 1 to 4 was also employed along with Aiken's formula. This research formulated three models of rhythmic gymnastics exercise from the document analysis stage, including a jump exercise model with a seven-post circuit, a pivot exercise model with a three-post circuit, and a balance exercise model with a six-post circuit. Following the experts' judgments, the jump, pivot, and balance game models were considered excellent for potential implementation in primary schools.

Keywords: game-based exercise, rhythmic gymnastics, primary school, gross motor skills

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INTRODUCTION

In physical exercise education, gymnastics is systematically designed and implemented to shape and develop the gross motor skills of the pupils in a harmonious manner (Chiat & Ying, 2012). Gymnastics can be broadly defined as any form of physical exercise that is systematically performed using a range of planned and selected movements for specific purposes (Gantcheva et al., 2018), which aligns with the objective of physical exercise education in primary schools. Gymnastics can be classified into artistic, rhythmic, trampoline, power tumbling, acrobatic, and aerobic gymnastics (FIG Executive Committee, 2017).

Rhythmic gymnastics belongs to stabilizing motion and manipulation of different motor skills using tools and the body simultaneously. Rhythmic gymnastics also uses a sense of beauty or art to promote and enhance the art of movement. Generally speaking, rhythmic gymnastics is identical to regular gymnastics but incorporates elevated rhythmic elements. The emphasis of rhythmic gymnastics must be on rhythm, flexibility, and continuity of movement (Sukmawati et al., 2020). Rhythmic gymnastics is a combination of rhythm and physical activity ideal for improving motor skills and physical abilities, based on the characteristics and structure of the movements. This is evident in the locomotor movement components that can increase strength, speed, power, endurance, balance, and dynamic agility (FIG Executive Committee, 2013). Rhythmic gymnastics is also known to involve free (motor) movement and rhythmic harmony.

The development of gymnastics that attempts to channel the desire for joy in movement gave rise to rhythmic gymnastics. Continuous movements are required in rhythmic gymnastics, with no room for interruptions. Flexibility, litheness, and balance are required for each move in rhythmic gymnastics. A continuous rhythmic movement might include (1) basic step movements like regular step movements, immediate steps, front steps, and side steps; (2) jumping movements like forward jumps, side jumps, and deer jumps; and (3) arm swing movements like swinging the arm at shoulder height, swinging the arm up, pushing the hand up, and stretching the arm.

Concerning rhythmic gymnastics, gross motor skills must be performed to the beat of the music or rhythmically timed free activities in rhythmic gymnastics (Chiat & Ying, 2012). There are options for individual and group rhythmic gymnastics training and learning, with rhythmic gymnastics being a process-based, creative, and aesthetic activity performed to music. It requires a specific and focused training method such as training with very young athletes, early specialization, high volume, high repetition, and high-stress level training (Debien et al., 2019). According to the age range and performance level, rhythmic gymnastics competitions are often held from the less famed regional competition to the more prestigious national competition (Rodríguez-Negro et al., 2020). Due to its extreme complexity, rhythmic gymnastics is considered a discipline that demands a high degree of motor skills and various coordination and aesthetic challenges (Vernetta et al., 2017). Rhythmic gymnastics requires a mastery of five types of manual equipment (ropes, rings, balls, sticks, and ribbons) and physical elements that combine the diverse aspects of high-level motor abilities. These requirements apply to training and competition facilities (Bobo-Arce & Méndez-Rial, 2013). An efficient game-based approach (GBA) is expected to achieve the objective of physical education, which is to develop students' gross motor skills.

Several GBA studies have provided some potential suggestions as an alternative method of contextualizing training or learning through activities like rhythmic movements incorporated into games. GBA calls for the coach to adopt a facilitator role and use questions to encourage opportunities for conversations and player reflections (Harvey & Light, 2015; Piazza et al., 2014; Roberts, 2011). When Bunker & Thorpe (Webb et al., 2006) presented Teaching Games for Understanding (TGfU), GBA which was initially established in European nations like France and Germany through the work of Mahlo and Deleplace (Roberts, 2011), first caught the attention of the English-speaking community. GBA training models, primarily as methods for coaches and physical education teachers to cultivate a sense of game appreciation and tactical awareness in their students, ultimately improve performance. Since the launch of TGfU, additional GBAs have appeared, each with modest modifications to the original TGfU model based on various cultural adjustments (Harvey & Jarrett, 2014). The findings of the study led to the creation of products that combine games with training and movement learning such as Game Sense (Light & Georgakis, 2005), Tactical Game Models (Mitchell et al., 2006), Play Practice (Launder, 2001), Integrated Tactical-Technical Model (Ros & Castejón, 1998), Invasion Game Competence Model (Mesquita et al., 2012), Ball School (Kroger & Roth, 2005), Tactical Decision Learning Model (Godbout & Gréhaigne, 2020), and Game Concept Approach (Rossi et al., 2007). Despite the varied cultural interpretations of GBA, Harvey & Light (2015) argues that GBA has four characteristics in common: (1) the design and modification of games and practice activities, (2) the use of questions, (3) the provision of opportunities for dialogue, and (4) the creation of a supportive social-moral environment. However, earlier studies indicate that the development of learning and training models with GBA is more focused on sports games, specifically invasion sports groups and net games, with game-based approaches that prioritize martial arts or gymnastics, particularly rhythmic gymnastics, being used infrequently.

Based on the observations mentioned above, there have been relatively few studies on the various learning materials concerning game-based rhythmic gymnastics, particularly in terms of the exercises offered in implementing GBA to fulfill the objectives of physical education. Therefore, this study aims to develop a model of rhythmic gymnastics exercises for elementary school children's gross motor skills development. This model represents one of the latest paradigms in learning for physical education. This model's creation represents a paradigm pertinent to physical education in the industrial era 4.0 and the 21st-century educational paradigm

that promotes innovation and creativity via play. The newly created game-based rhythmic gymnastics exercise model is expected to provide teachers and trainers with opportunities for experimenting and exploring their creativity to meet the very objectives of physical education.

METHOD

This research employed both qualitative and quantitative methods. This mixed-methods study combines qualitative and quantitative methods to acquire more comprehensive and valid data. In mixed methods research, researchers use qualitative and quantitative research methods sequentially or concurrently to examine a topic in depth. This research was divided into two stages: the first phase was a sequential qualitative exploratory method to identify a game-based exercise model to enhance the gross motor skills of rhythmic gymnastics in school-aged children. Data collection included a narrative review technique based on a literature review (Ferrari, 2015). The literature review process consists of four parts, the first of which is searching various databases for scientific articles. This research drew data from scholarly publications and textbooks on the topic of this study. Google Scholar, Proceedings of the National Academy of Sciences, and PubMed are used for data collection. The second stage was to identify keywords, based on the study topic (exercise model, rhythmic gymnastics), to locate or search for papers that are relevant to the research topic. After locating articles relevant to the research topic, the third phase included reviewing and critically examining many abstracts and articles by highlighting the limitations and differences of several journal articles in narrative form. The fourth step is to summarize and synthesize the data from the selected relevant publications, which are then included in research works or manuscripts as weaknesses and differences in improving rhythmic gymnastics skills through practice. The author transforms the existing rhythmic gymnastics training model into a rhythmic gymnastics exercise model utilizing new games-based coaching, based on the limitations of the exercise method used to strengthen the gross motor skills of rhythmic gymnastics.

The second phase of this research used quantitative research to test the content validity of the game-based exercise model to develop the gross motor skills of rhythmic gymnastics for schoolchildren, as determined in the first stage. Seven academic and professional experts participated. It comprised three academic experts with a doctorate in gymnastics and four professionals with a trainer certification at the provincial level or higher. The data were also collected using the Delphi method (Cox et al., 2016; Qowiyyuridho et al., 2021). The Delphi technique is a data-gathering method in which experts independently evaluate training models for rhythmic gymnastics using games-based coaching (Fraenkel et al., 2012). In other words, each rater who evaluates the model did not meet each other (Yudhistira et al., 2021). This study utilized a questionnaire with the following indicators: (1) the type of game-based exercise relevant to the basic movement skills of rhythmic gymnastics; (2) the type of game-based exercise is relevant to the child's abilities; (3) the intensity of game-based exercises is relevant to the child's abilities; (4) the frequency of game-based exercises is relevant to the child's abilities; and (5) the duration of game-based exercises is relevant to the child's abilities. A score of one is considered irrelevant, a score of two is considered less relevant, a score of three is considered relevant, and a score of four is considered highly relevant. Using the Aiken formula, data analysis was conducted. The following is Aiken's formulation (1).

$$V= (\sum(ri-lo))/[n(c-1)] \quad (1)$$

Description:

V = The index of rater agreement on the validity of an item equals the number given by the rater.
lo = the lowest rating score of validity (1 on a scale of 1-4)
c = the highest validity rating score (4 on a scale of 1-4)
n = the number of experts who perform the assessment

FINDING AND DISCUSSION

Finding

Quantitative and qualitative findings

The models for the games were designed based on the findings of game-based training studies that were previously obtained through the literature review. The three game-based gymnastics exercise models are explained as follows:

Jumping game model

Performers or the children can combine several movements, from simple ones to rotating by jumping. Figure 1 illustrates the model and provides additional information on each post.

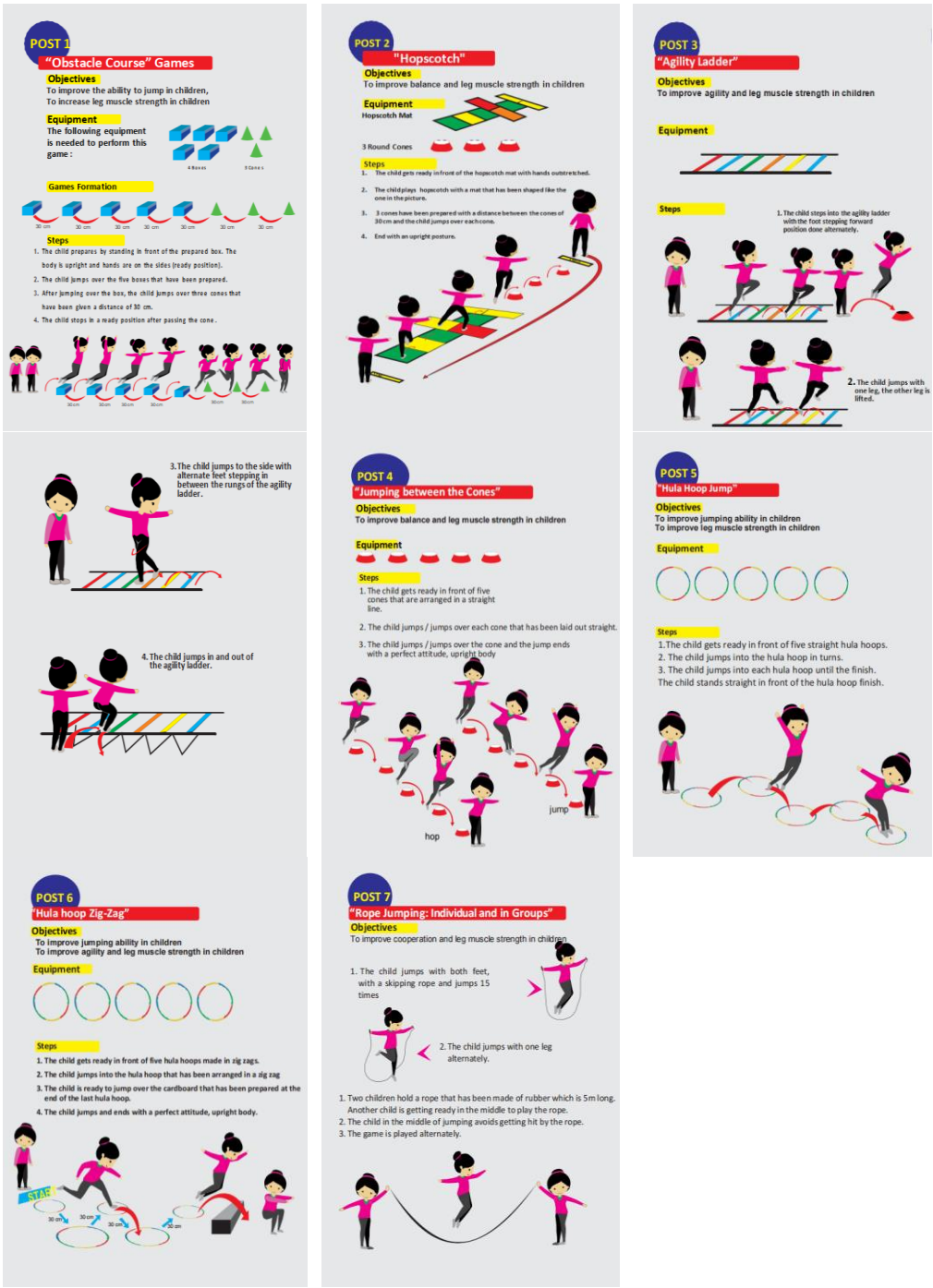

Figure 1. The Jump Games Model

The basic element or composition that enables the player to move through the air while performing a series of movements in a circuit is the jumping motion. Exercises that involve jumping are among the most effective means of increasing the maximum power of certain muscles. Explosive stretching (extending) of the muscles in the initial movement is the best technique to increase the power. Leg movements in the opposite direction (cropping), known as the pre-stretching phase, are used to build muscular leg power. After landing, a forceful upward jump is performed without any pauses. The children then move their legs in the opposite direction of how they move their arms. An eight-pole jumping game model has been created utilizing the circuit training technique. Three steps make up the jumping game's concept: (1) a warm-up exercise, (2) an exercise involving children running and jumping without pausing over obstacles at each post, with three-minute pauses in between each round and each child repeating moving through the circuit three times, (3) a cool-down exercise. There are seven posts in the jumping game model in total. As illustrated below, children go through post 1 which involves an obstacle course. Upon completion, children may go through post 2 which consists of hopscotch, and then perform movements in post 3 which involves agility ladders. Post 4 encourages the children to keep their balance while jumping between cones. Children can then move through post 5 involving a hula hoop leap, and complete post 6 involving a zigzag hula hoop. Lastly, in post 7 children may perform rope jumping individually or in groups.

Rotation game model

The rotation game is a quick one-leg rotation performed by the gymnasts. During the rotational movement, the gymnasts must keep their balance and consequently their bodies stable. Depending on how comfortable the children are, this circular movement exercise's main goal can be achieved by standing up or lying down on the mattress. Depending on the individual's skill level, the children may do as little as one, two, or as many as three rounds while the free leg is positioned in various places, such as the stance position. The researchers discovered the rotation game model with three poles which use the circuit training technique. The steps of the rotation game model are as follows: (1) warm-up; (2) students doing one round, two rounds, or three rounds of movements, depending on their skill level. The rotation game model comprises three post-game scenarios: a hula hoop zigzag utilizing a mat, a gym ball relay, and a rotation variant game. With three-minute pauses between each round, each child repeats the exercise three times. Figure 2 shows detailed information regarding this game model.

Figure 2. The Rotation Games Model

Balance games model

During a series of movements, balancing is a short, regulated activity that can be thought of as a brief period of stillness (3 seconds). The posture dynamics to prevent falling is called "balance" in general. Essentially, balance can be described as the capacity to direct the body's center of mass or center of gravity towards a point or fulcrum, as well as the capacity to support one's weight on both of one's main legs while standing upright as a prerequisite to

performing other daily activities. An athlete must perform one of these motions, which display unique patterns specific to the gymnastics discipline. One of the limitations of exercising balance is that athletes may not have enough variations while performing the exercise. The researchers developed a model for the five-post balance game using the circuit training method. The rotational game model is broken down into (1) a warm-up; (2) a 3-second stillness before the children complete a series of game movements for each post. Examples of balance games include the balance block challenge, tower guard challenge, hula hoop zigzag challenge, body balance challenge, and balance ball challenge. These games are effective starting points for developing students' balancing skills. These are illustrated in more detail in Figure 3.

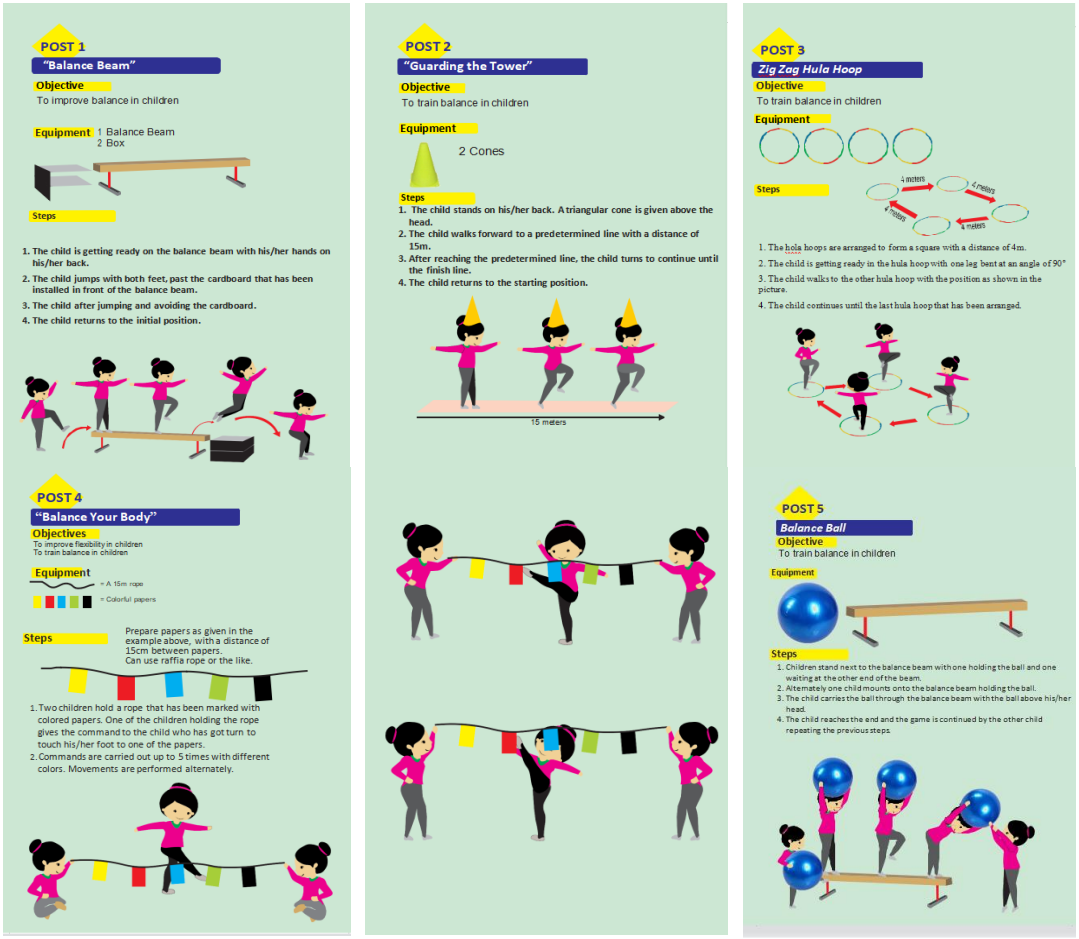

Figure 3. The Balance Games Model

Results of the validation of game-based coaching models

Experts' evaluation involving academics and professional trainers concerned five agreed-upon aspects, including (1) the suitability of the concept of jump, pivot, and balance game models with the learning objectives and characteristics of primary school students, (2) the suitability of the number of stimuli for the models of jump, pivot, and balance games with the objectives relevant to and characteristics of primary school students; (3) the practical aspects of the number of stimuli for the models of jump, pivot, and balance games with the objectives relevant to and characteristics of primary school students, (4) the aspects of ease of procedure for the models of jump, pivot, and balance games; and (5) the aspects of the workload progression of the models of jump, pivot, and balance games. In the experts' evaluation, the researchers utilized a scale of 1 to 4. The closer the assessment is to number 1, the more irrelevant it is the closer it is to number 4, the more relevant it is. The data from the experts' assessments were then statistically analyzed using Aiken's formula. The validity test results are summarized in Table 1.

Table 1. Results of expert evaluation

Rater	Aspect 1		Aspect 2		Aspect 3		Aspect 4		Aspect 5	
	Score	ri-lo	Score	ri-lo	Score	ri-lo	Score	ri-lo	Score	ri-lo
1	3	2	4	3	3	2	4	3	4	3
2	4	3	3	2	4	3	4	3	3	2
3	4	3	3	2	3	2	4	3	4	3
4	4	3	3	2	3	2	3	2	4	3
5	3	2	4	3	3	2	4	3	4	3
6	4	3	3	2	4	3	4	3	4	3
7	4	3	4	3	3	2	4	3	4	3
∑ri-lo		19		17		16		20		20
V		0.904		0.809		0.761		0.952		0.952

The results show that the experts' assessments of the three models suggest (1) a degree of suitability of the jump, pivot, and balance game models and that they are relevant to the learning objectives and the characteristics of primary school students, with a value of V=0.904; (2) a degree of suitability of the number of stimuli for the jump, pivot, and balance game models in its relevance to the learning objectives and the characteristics of primary school students, with a value of V=0.904; (3) the practical aspect of the jump, pivot, and balance game models with a value of V=0.761; (4) the procedural ease of the jump, pivot, and balance game models with a value of V=0.952; and (5) the aspects of workload progression of the jump, pivot, and balance game models with a value of V=0.952. Aiken's V coefficient value ranges from 0 to 1, with 0.76 as the minimum standard value for validity. The V values of the three models all exceed 0.76, indicating that all aspects of the three models are valid. In other words, all experts agree on the models of the jump, pivot, and balance games with a significant validity rating.

Discussion

This study identified the jump, rotation, and balance games as three game-based coaching models for rhythmic gymnastics training for primary school students. The three models employ the circuit approach, with three-minute rests between circuits. The jump game model represents a game that incorporates a jumping activity. The steps in the jump game model begin with a warm-up exercise, followed by the students completing one circuit by consecutively moving through seven posts of jumping activities. Each student completes the circuit three times with three-minute rests in between. At the end of the series of activities, a cool-down session takes place and feedback is provided. The development of the jumping game model is supported by the findings of Batista et al. (2023), who assert that jumping exercise is critical for improving athletes' performance in rhythmic gymnastics. It was also discovered that leaping movement strongly connects to rhythmic gymnastics. Breitkreutz & Hökelmann (2015) found that jumping exercises can help enhance leg muscles and the static and dynamic balance in rhythmic gymnastics. Additionally, the findings of this study corroborate Piazza's et al. (2014) research, which indicates that jumping exercise can improve rhythmic gymnastics skills overall.

The rotation game model deals with performing 180-degree body rotation through jumping motion that is being incorporated into game exercises. The first stage in this rotation model is to warm up, followed by students rotating their bodies while jumping from post one to post three to complete a circuit. Each student completes the circuit three times with three-minute rests in between. At the end of the activity, the students are allowed a cool-down phase and feedback is given. This finding is corroborated by Nazari & Boon Hooi (2019) findings, which indicate that jump training with a 180-degree rotation and core training can help improve rhythmic gymnastics performance. The findings of this study also agree with Agopyan's (2014) and Ávila-Carvalho's et al. (2012) studies, which suggest that 180-degree to 360-degree rotation exercises increase rhythmic gymnastics performance.

The balance game model is a three-second exercise requiring students to maintain one leg balance. The phases in this balance game model begin with a warm-up, followed by students maintaining balance in each activity of six designed posts acting as a single circuit. Each student completes the circuit three times with three-minute rests in between. A cool-down session and

feedback are provided at the end of the activity. According to Rutkauskaite & Skarbalius (2012), balance is one of the major aspects of rhythmic gymnastics that needs to be developed early. Additionally, Tincea's (2020) study suggests that balancing exercises substantially enhance rhythmic gymnastics skills.

Referring to the results of the experts' assessments on the three rhythmic gymnastics training models, it can be concluded that experts agreed on game-based rhythmic gymnastics learning and training models, namely the jump games, rotation games, and balance games, with a V value for each aspect (conformity of the concepts to the student's goals and characteristics, appropriateness of the number of stimuli, ease of procedures, workload progression, and practicality) suggesting valid training models. These results place the training models developed in this study with some earlier model development studies with V values greater than 0.76 (Ilham & Tomoliyus, 2021; Yudhistira et al., 2021; Yudhistira & Tomoliyus, 2020). Ultimately, all the experts agreed that the jumping, rotation, and balance game models could be implemented to train rhythmic gymnastics in primary schools.

CONCLUSION

This study aims to develop effective game-based exercise models to train rhythmic gymnastics in primary schools. The game models were designed based on a comprehensive review and analysis of carefully selected literature on rhythmic gymnastics. The developed models were then presented to experts to assess their potential implementation in rhythmic gymnastics training in primary schools. The results and discussion in this study suggest that the models of jumping, rotation and balancing games all demonstrate high "V" Aiken scores, indicating the suitability of the models to be implemented in schools. In conclusion, trainers and teachers can use the three game-based models to help primary school students learn and practice their skills in rhythmic gymnastics.

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