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THE EFFECT OF MUSIC ON FREE THROW PERFOMANCE WHEN PLAYING BASKETBALL

Tony Wibowo, Jeremy Riantono
Faculty of Computer Science, Batam International University
{ tony.wibowo@uib.ac.id 1831083.jeremy@uib.ac.id }

ABSTRACT

This study was conducted to find out how music affects basketball free throw performance. The influence of music in free throws is considered important for building tension and adrenaline in a match, and it is rarely reported in the scientific method how music in free throws affects players. This study uses qualitative methods using experimental methods. This free throw experiment used four parameters and four changes in musical tempo, and each parameter consisted of 30 participants. The parameters we use are in and out of the ball, using scoring, pre-shot time, and time during the shooting phase. Experimental results show that music can have a positive impact on free throw performance. Music has significantly impacted performance in free throws which require good tension and adrenaline

INTRODUCTION

Music has become such an important aspect of human evolution and culture that it may even predate verbal communication (Karow et al., 2020). Music fills various activities and our daily lives. Weddings, funerals, and initiation ceremonies such as rituals that mark entry or acceptance into a group or society make music a very important part. Mothers use it instinctively to offer comfort to a restless child. The music stirred up soldiers preparing to enter the field and coordinated their next march. Music also covers many aspects of exercise and exercise. Indeed, music is so fundamental to the human condition that the German philosopher Friedrich Nietzsche famously stated, "Without music, life would be a mistake." (Terry et al., 2019).

Any musical composition or performance requires the organization of four key elements such as melody, harmony, rhythm, and dynamics (Koelsch et al., 2019). Melody is the strain of a piece of music, which is the highest pitched part that people can hum (Cirelli et al., 2018). Harmony requires a combination of notes that are simultaneous and will always shape the mood of the music making a person feel happy or sad, tense, or romantic (S. Wang & Agius, 2018). Dynamics deals with the energy emitted by musicians through their breath or touch to affect the volume of their instrument. It is this element that tends to immediately trigger a physical reaction from the listener, such as a nod of the head, tapping of toes, or even a spontaneous dance (Cancino-Chacón et al., 2018). The last element of music, namely rhythm, requires the speed of the music and how its various components are accented over time (Karageorghis, 2020). Rhythm is the beat of music that can be measured by producing beats per minute (bpm). The higher the bpm, the faster the beat of the music (Wibowo, 2019).

Basketball is a high-intensity sport that requires good strength and endurance. Activities in basketball are a combination of aerobic and anaerobic activities and require high energy (Putri & Dhanny, 2021). Basketball is a sport consisting of two teams of five people each. This sport requires a high intensity of motion such as running, jumping, stopping and having to move around according to the situation in the game (Malik & Rubiana, 2019). There are three basic techniques in basketball, namely shooting, passing, and dribbling (Kartiko et al., 2019).

The most practiced exercise in basketball is shooting. Two important types of basketball shots are jump shots and free throws (W. Wang et al., 2019). The most common and very important type of shot in basketball is the jump shot, which consists of the shooter's jumper and ideally releasing the ball at or near the top of the jump (Vickers et al., 2017). One of the winning factors is free throws, which is an attempt to score points without a hitch by shooting from behind the foul line where the foot does not leave the ground. Free throws play a very important role because they can be a

decisive factor in winning the game, especially when the end of the game with a fierce score (Maglott et al., 2017). Based on the background described above, we will make a study entitled "The Effect of Music on Free Throw Performance When Playing Basketball".

PROPOSED INNOVATION

Based on the background that has been mentioned, Music has become such an important aspect on human life, music fills various activities and our daily lives. Therefore, we conducted research which aims to make an experiment for basketball player to see what the effect on hearing music at free throw was.

The aim of this research is to find out what is the effect without music or with music at a certain rhythm on a person's free throw performance when playing basketball.

LITERATURE REVIEW

This research that entitled "The Effect of Music on Free Throw Performance When Playing Basketball", based on several research that have been conducted previously, namely as follows:

Research conducted by Wibowo, (2019) is research that is the main basis in developing the topic this. In this study, we used a qualitative and quantitative approach using experimental methods to further prove the correlation. The purpose of this study was to determine whether music can affect the experience of playing video games. This study uses methods, namely Problem Identification, Research Design, Data Collection, Data Processing and Data Analysis. We conducted an experiment using four variations of music on three with 30 players each. Experimental results show that depending on the video game genre, music can have a positive effect on game performance. Questioning each participant showed that music was highly correlated with video game experience and player performance. Music affects the performance of fast-paced and responsive games, but it goes unnoticed in slow tactical games.

The next research is research that has been carried out by Karageorghis, (2020) is developmental research. The purpose of this study was to determine the disorders associated with music in sports. Some of the key conclusions that can be drawn are that: (1) music reduces perceived exertion at low to moderate exercise intensity, but does not appear to do so at high intensity (beyond the anaerobic threshold); (2) well-chosen music can increase exercise-related effects on all intensities and the brain mechanisms underlying the relationship between music influence during exercise are beginning to be revealed; (3) music can have a mild ergogenic effect or increase work in various activities; and (4) the application of synchronous music results in greater neuromechanical efficiency, which can reduce energy expenditure in certain workloads.

The next research is the research that has been done by Terry et al., (2019) is a research with a qualitative approach. The purpose of this study was to determine the effect of music in exercise and sports. Regular physical exercise has many benefits for both physical and mental health, and music has been shown to have a positive effect on physical exercise. Summative literature reviews and conceptual models have hypothesized potential benefits and salient mechanisms associated with listening to music in the context of exercise and exercise, although no large-scale objective summary of the literature has been conducted. A multilevel meta-analysis of 139 studies was used to measure the effects of listening to music in the exercise and exercise domains. In total, 598 effect sizes from the four categories of potential benefit (psychological response, physiological response, psychophysical response, and performance outcome) were calculated based on 3,599 participants. Music was associated with significant beneficial effects on affective valence, physical performance, perceived exertion, and consumption. No significant benefit of music was found for heart rate. The performance effect was moderated by the study domain that exercise was better than exercise and fast music tempo was better than slow and medium. Overall, the results support the use of music listening across a variety of physical activities to promote more positive affective valence, increase physical performance (ergogenic effects), reduce perceived exertion, and increase physiological efficiency.

Furthermore, other supporting research conducted by Maglott et al., (2017) is research with a qualitative approach with experimental methods. This study aims to identify the timing characteristics of arm movements during basketball free throws and jump shoots using a sensorized worn on the body. For both trials, shots made were eliminated from consideration for analysis if the

ball 1) touched the backboard before passing through the rim, 2) moved upwards after touching the rim, or 3) touched the rim more than once. Missed shots will be eliminated from consideration for analysis if the ball does not touch the rim. For Experiment 1, both trained and novice shooters were instructed to fire a set of shots from the free-throw line. Each competitor shoots at least 20 free throws with a rest period offered after every 5 shots. For Experiment 2, the trained shooter was instructed to fire a jump shot from behind the free throw line. The free throw shot data from Experiment 1 was used for analysis to compare with the jump throw data from Experiment 2. The results from this experimental test found that trained shooters fired free throws faster than novice shooters, and trained shooters fired jump shots faster than free throws at the same distance from the rim.

Another supporting research is the research conducted by Malik & Rubiana, (2019) is a research with a descriptive qualitative approach. The purpose of this study was to determine the physical education students who entered through the SBMPTN pathway in 2019 on their basic basketball technical abilities. This study was studied with 130 students aged 17 to 21 years. The instrument used is a test of passing to the wall with a 3 meters distance for 30 seconds, a test of dribbling the ball with a zig zag and a shooting for 30 seconds. Data were analyzed using descriptive statistical techniques. From the results of the study obtained information that the average basic technical ability of students' basketball is in the sufficient category based on the reference value assessment.

Researcher	Years	Application of Research
Wibowo, Tony	2019	This study used a qualitative approach with experimental and quantitative methods to determine whether music can affect the experience of playing video games.
Karageorghis, Costas I.	2020	This study is a developmental study to determine disorders associated with music in sports.
Terry, Peter C. Karageorghis, Costas I. Curran, Michelle L. Martin, Olwenn V. Parsons-Smith, Renée L.	2019	In this study, a qualitative approach was used to determine the effect of music in exercise and sports.
Maglott, Jonathan C. Xu, Junkai Shull, Peter B.	2017	In this study, a qualitative approach with experimental methods was used to identify the characteristics of the timing of arm movements during basketball free throws and jump shoots using sensorized arms worn on the body.
Malik, Arief Abdul Rubiana, Iman	2019	In this study, a descriptive qualitative approach was used to determine the basic technical ability of basketball in physical education students who entered through the SBMPTN pathway in 2019.

From these studies, we will carry out his research, namely analyzing whether music can affect a person's performance when doing free throws with experimental methods as carried out by (Wibowo, 2019) and (Maglott et al., 2017). We will also explain the musical composition as done by (Karageorghis, 2020). We will also analyze the influence of music in sports, especially in basketball (Terry et al., 2019) by using the basic basketball technique in the form of free throws to measure it (Malik & Rubiana, 2019). Thus, the conclusion is obtained as the main basis in analyzing whether music can affect a person's performance when doing free throws.

RESEARCH METHODOLOGY

This research that entitled "The Effect of Music on Free Throw Performance When Playing Basketball" is a study that uses a qualitative approach. The flow used comes from the main journal which is described in Figure 1:

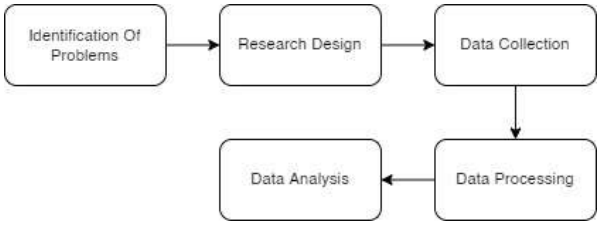

Figure 1. Research Flowchart

Identifying the problem is an important step in research. By identifying the problem, the researcher can determine to find out what the effect without music or with music at a certain tempo on a person's free throw performance when playing basketball. Then at the research design stage, we prepared the components needed when data collection takes place such as Bluetooth speaker, basketball, and camera. There are 4 variants of music and audio used for this experiment: No Music, Low BPM, Medium BPM and High BPM Music. Moderate tempo (108-128 bpm) or andante (98-108 bpm) can be used as a benchmark as music that has a medium tempo, while slow tempos such as adagio (65-76 bpm) and adagietto (70-90 bpm) and all tempos below are considered. as a slow tempo, and for a fast tempo such as Vivace (156-176 bpm) and Presto (>168 bpm) (Wibowo, 2019).

The music playlist of this research are as follows:

1. Kingdom Hearts II - Dearly Beloved (Extended) [55 BPM (*Low*)]
2. Us – Miscél [79 BPM (*Low*)]
3. Summer Solstice - Moody Me [77 BPM (*Low*)]
4. Things Unsaid - Marcos Betancourt [70 BPM (*Low*)]
5. Payday 2 - Blastaway (Assault Extended) [128 BPM (*Medium*)]
6. FISHER - Losing It (Official Audio) [125 BPM (*Medium*)]
7. FISHER - You Little Beauty [124 BPM (*Medium*)]
8. FISHER - Ya Kidding [125 BPM (*Medium*)]
9. Workout Music Source // Run to The Beat 2 [160 BPM (*High*)]
10. Yellow Claw & Juyen Sebulba - Can't Help Myself [160 BPM (*High*)]
11. Bro Safari - The Drop (Official Audio) [170 BPM (*High*)]
12. Darren Styles - Switch (Official Video) [160 BPM (*High*)]

Then, we chose Batam International University Sport Hall to be used for the experiment. After that, samples were taken from active students from Batam International University, not based on gender, study program or semester. Samples were taken as many as 30 people (Anisa et al., 2019). Each sample is given 5 opportunities to shoot the ball. Then at the data collection stage we will conduct experiments on participants. After that, record the experimental process for data processing. In shooting the video, we use a Fujifilm XT-100 camera and a Fujifilm 15-45mm kit lens. We set the Fujifilm camera settings with a frame rate of 59.94 frames/second, frame width x height (1280 x 720). Figure 3 shows the recording position in the process of shooting the ball.

Figure 3. Recording Position

Then, at the data processing stage we will Summarizes the data from the video recordings that have been recorded, based on the data that has been obtained. After that, the data that has been processed will be analyzed so that it gets a conclusion for the problem in the analysis stage.

RESULT AND DISCUSSION

The summary of data that obtained by us in this research are as follows:

1. Entering or Not Entering the Ball

In this parameter, we add up the total entry of the ball into hoop and not the entry of the ball. In 5 attempts to shoot the ball, we recorded the results of entering and not entering the ball. In figure 4 shows the results of the data obtained from the average count on the average of every 30 players in each category. In the minimum column, which is the smallest number scored by players in each category, the maximum column is the highest number scored by players in each category.

Category	Minimum	Average	Maximum
No Music	0	1.554839	4
Low BPM	0	1.633333	4
Mid BPM	0	2.166667	4
High BPM	0	2.066667	4

Figure 4. 1st parameter data

2. Using Score

In this parameter, we add up the points that have been obtained by the player. Figure 5 shows the criteria that will be calculated by us.

Score	Description
1	Ball misses rim completely.
2	Ball hits outside of the rim and bounces away from the basket.
3	Ball hits the backboard of the rim and falls through the basket.
4	Ball hits on the inside of the rim and falls through the basket.
5	Ball passes cleanly through the basket without touching the rim.

Figure 5. Scoring criteria

Figure 6 shows the results of the data obtained from the average calculation on the average of every 30 players in each category. In the minimum column, which is the number of lowest scores obtained by players in each category, the maximum column is the number of highest scores obtained by players in each category.

Category	Minimum	Average	Maximum
No Music	1.2	2.546667	3.6
Low BPM	1.6	2.626667	4
Mid BPM	2	2.986667	4
High BPM	2	2.893333	3.6

Figure 6. 2nd parameter data

3. Pre-shot Time

In this parameter, we will use a timer to calculate the time (milliseconds) needed by the player from receiving the ball, until the start of the shot phase. Figure 7 shows the results of the data obtained from the average count on the average of every 30 players in each category. In the minimum column, which is the fastest time obtained by players in each category, the maximum column is the longest time obtained by players in each category.

Category	Minimum	Average	Maximum
No Music	73.8	123.0067	210.2
Low BPM	88.8	130.6067	261.8
Mid BPM	79.2	143.3533	240
High BPM	81	113.0933	180.8

Figure 7. 3rd parameter data

4. Shooting Phase Time

In this parameter, we will use a timer to calculate the time (milliseconds) needed by the player from the initial phase of the shot or when the start to shoot the ball begins, until the ball is released. Figure 8 shows the results of the data obtained from the average count on the average of every 30 players in each category. In the minimum column, which is the fastest time obtained by players in each category, the maximum column is the longest time obtained by players in each category.

Category	Minimum	Average	Maximum
No Music	36	51.08667	72.4
Low BPM	34.8	51.92	85.2
Mid BPM	31	54.71333	81.8
High BPM	35.2	50.86667	64

Figure 8. 4th parameter data

This research has achieved the goal that the public aware about the influence of music on a person's free throw performance when playing basketball. Based on 30 participants doing free throws on different music treatments with different data measurements. The results of the free throw test on the measurement of the entry and exit of the ball, the experiment without music showed the lowest average results among Low BPM, Mid BPM, and High BPM. At Low BPM the average

results were found to increase by about 5%, while Mid BPM the average results were found to increase drastically by around 40%, at High BPM the average results were found to increase by about 32%, the highest results were obtained in the measurement of whether the ball enters or does not enter a free throw with music is with Mid BPM music.

The results of the free throw test on measurements using scores, experiments without music showed the lowest average results among Low BPM, Mid BPM, and High BPM. At Low BPM the average results were found to increase by about 3%, while Mid BPM the average results were found to increase drastically around 17%, at High BPM the average results were found to increase by about 14%, the highest results were obtained in measurement using scores in doing free throws with music is with Mid BPM music.

The results of the free throw test on the measurement of pre-fire time, the experiment without music showed results with an average of 123,0067 between Low BPM, Mid BPM and High BPM. At Low BPM the average yield was found to have increased by around 6.1%, while the Mid BPM average yield was found to have increased dramatically by around 16.5%, at High BPM the average yield was found to have decreased by about 8%, the longest result was obtained at measurement of pre-fire time in doing free throw with music is with Mid BPM music.

The results of the free throw test on the measurement of the firing phase, the experiment without music showed results with an average of 51.08667 between Low BPM, Mid BPM and High BPM. At Low BPM the average yield was found to have increased by about 0.2%, while the Mid BPM average yield was found to have increased dramatically by around 7.1%, at High BPM the average yield was found to have decreased by about 0.5%, the longest result was obtained at the measurement of the firing phase time in doing free throws with music is with Mid BPM music.

It can be seen from the results of all measurements in the free throw test that listening to music has significantly affected the free throw performance. Especially at Mid BPM can consistently improve performance 20.15% better in free throws. At High BPM performance increased by 9.37% better in free throws. At Low BPM performance increased by 3.57% better in free throws.

These results show that music is very influential on free throws because it triggers various emotions, changes, or regulates moods, increases work output, increases adrenaline, reduces obstacles, and encourages rhythmic movements. Music has ergogenic properties which are substances that increase energy production, energy control or energy efficiency during a sports performance that provides greater additional capabilities than regular exercise. This increase is caused by physiological and psychological mechanisms, which ultimately leads to an increase in a person's performance.

From the results from this experiment, without music has produced a standard average. Based on the results of the data on the 4 treatments, the average results without music showed the lowest compared to Low BPM, Mid BPM, and High BPM. Among all the music tempos, Mid BPM has dominated from all of them, Low BPM music makes players sleepy, lowers tension, then the adrenaline needed when exercising is lost, so the player does not produce good performance. If listening to High BPM music makes the player's adrenaline go too fast so that the player's adaptation to exercise is not good, this causes the player to be too hasty during the shooting phase which results in the player's performance being less good.

This result proves that the music with Mid BPM is the best, this is proven by the music that was played during the competition on average using Mid BPM, not High BPM played in the Bar or Low BPM played in the Café. The results of the study (Wibowo, 2019) show that as many as 2 games have proven that listening to music with Mid BPM has significantly affected performance.

Basketball is a high-intensity sport that requires good strength and endurance. Activities in basketball are a combination of aerobic and anaerobic activities and require high energy. That’s why we should hear music to create ergogenic properties which are substances that increase energy production, energy control or energy efficiency during free throw that provides greater additional capabilities than without hearing music. This increase is caused by physiological and psychological mechanisms, which ultimately leads to an increase in a person's performance.

One of the winning factors in basketball is free throws, which is an attempt to score points without a hitch by shooting from behind the foul line. Free throws play a very important role because they can be a decisive factor in winning the game, especially when the end of

the game with a fierce score. So, in that fierce score moment, the team should use the Mid BPM music for a higher chance to score the ball.

LIMITATIONS

Because this research was conducted during the covid-19 pandemic, we experienced several difficulties, including the difficulty of finding samples and finding the date for the experiments.

FUTURE WORK

We hope that this research can be continued by other prospective researchers with other scopes. The scope can be focus on professional basketball players to get more valid data. It can also to research music against other sports, such as speaking football, swimming, badminton, or other sports. Therefore, we hope that further research can change the sex of the respondent to female to see if there was a difference in treatment between male and female players.

CONCLUSION

Based on the results of this study, the following are some conclusions that can be drawn:

1. The results of the research on the influence of music on a person's free throw performance when playing basketball is a strategy for delivering information to basketball players in Indonesia because many people still do not know the effect of music played on basketball players who are doing free throws while competing.
2. The application of experimental methods in researching the effect of music on a person's free throw performance while playing basketball has a function to measure individual data results so that research can be understood and applied by other researchers as a research basis.
3. The results obtained in this study can be ascertained that music with has significantly affected performance in free throws, especially at Mid BPM as much as 20.15% compared to without music.
4. Research has shown that music has affected a person's free throws. Especially at Mid BPM which increased by 20.15% compared to no music. This research can be further investigated in other sports including eSports and non-sports such as work, study, and other activities.

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