

ACCEPTABILITY OF HAND - EYE - EAR COORDINATION TRAINING PAD IN TABLE TENNIS ATHLETES

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ABSTRACT

Hand-eye coordination is commonly heard of and understood as a concept in sports training and even sports skills, to further elaborate, the way that one's hands and sight work together to be able to do things that require speed and accuracy (Merriam-Webster Dictionary, 2022). On the other hand, hand-ear coordination is defined as the spatial and temporal organization of hand movements as they point toward unseen auditory targets located in a horizontal plane in front of them. (Boyer et al., 2013). The researchers aim to provide a positive outcome with the athletes' accuracy with their coordination as they keep on training with the device. The device aims to be an acceptable sensorimotor training tool for Physical Therapists and would be more widely used as the device improves and becomes more acceptable. If given the chance it will seek to be seen as a staple in sports training as it will help athletes perform better in their respective sports. The methodology used in the study is quantitative research design, specifically survey design. And used primary and secondary data to gather resources in order to complete the study. According to Bhandari (2020), the process of gathering and interpreting numerical data is referred to as quantitative research. It can be used to identify patterns and averages, formulate hypotheses, examine relationships, and generalize findings to larger populations. With this design, the researchers conducted their studies and gathered data using surveys that provide open-ended questions that were answered using the Likert scale. Results of the study stated that the device is overall highly acceptable based on the mean of 4.24 that it attained and according to the verbal interpretation by Salac, D. (2020). This is based on the factors of design, features, ease of use, safety and functionality. Based on the results of the study, the researchers have concluded that the device is well-received by Physical therapists and that there is a lot of potential for other possibilities of implementing this device, limited not only to sports training but also in a rehabilitation setting for various conditions.

Keywords: Coordination, Training, Physical Therapy, Training device, Sports

1 Faculty

2 Student Researchers

INTRODUCTION

Hand-eye coordination and hand-ear coordination are two different areas of sensorimotor skills in an athlete. But they are needed for an athlete to perform at their very best. While they

are two different concepts, they both still belong in the whole-body coordination and how they all move within each other. . This is especially essential for athletes in any sport, but to be more specific the researchers will focus on table tennis athletes since they require these skills more than other sports, since the art of table tennis not only requires incredible focus, but it also requires a fair amount of hand-eye coordination. As the ball is hit across the table, you need to be quick enough to move your body and your arm in time to hit it back. As you practice the skills required for table tennis, you practice your tactical strategy, mental alertness, and your reflexes. Previous studies have shown some form of relationship in hand-eye coordination with table tennis players specifically with types of shots and serves. A study by Haryanto and Amra, 2020 focused on the relationship of hand-eye coordination with the accuracy of backhand backspin serves in table tennis and has yielded the following results 1) Concentration has a strong enough relationship with the accuracy of backhand backspin service, 2) Hand eye coordination has a strong enough relationship with backhand backspin service accuracy. 3) Concentration and hand eye coordination together have a strong enough relationship with backhand backspin service accuracy. Table tennis coaches should train concentration and eye-hand coordination to improve the athlete's service accuracy. This study supports the researchers' claims that improved coordination will yield better and improved table tennis skills. So far there has been little research about hand-ear coordination and its relationship with sport and athlete performance, in a study based on hand-ear coordination the results have shown the following: These results show that the improvement of precision in this condition may not only be due to better memorization of the target but also to the possibility to make online corrections of the hand trajectory.

The use of auditory information about target direction as feedback for guiding the reaching movement is likely since the kinematics showed indices of iterative corrections in condition B (in particular, increased length of the trajectory and increased number of peaks after PVP). These online corrections can be produced only if a neural process is able to use the auditory estimation of the target position and to make it available continuously to the sensorimotor process that drives the hand. Therefore, a sound still heard at the end of the pointing movement as in condition B would allow a more efficient updating of the goal representation in relation to the hand's position and thus a more accurate movement. (Boyer et al. ,2013) Vision is one of the several sensory organs which receive information from the external environment. One of the many sensory organs that gather data from the outside world is vision. The coordination of the Hand and Ear will be improved along with their perceptual skills with the help of the device. Previous research has shown that solely relying on visual training is not an effective training method, the researchers will aim to prove that sensorimotor training can affect athletes' performance on a positive note as they can perform better with better sensorimotor skills. In this study, the researchers are aiming to fabricate an acceptable training device for athletes in order for them to become better competitors by enhancing their so-called "intangibles" which in this case is their coordination.

LITERATURE REVIEW

For literature supporting the training for hand-eye coordination has shown positive results in terms of how training this specific sensorimotor skill can improve a person's performance based on multiple literatures evaluating different types of people and different types of professions. The following theme being reaction time, multiple studies have shown the relationship between reaction time and hand-eye coordination, notably the study by Kosinski (2013) showed how various different stimuli can affect how the motor aspect reacts towards it. There have been several reported and studied training methods and media for reaction time

which utilizes sensorimotor stimulation and feedback in aiding reaction time, one of them being Virtual Reality (VR) games and activities as stated by Rutkowski, S., et.al (2021). The implementation of virtual reality (VR) opens up a wide range of possibilities for the development of dexterity, speed and precision of movements. While there have been several researches regarding hand-eye coordination and sports, most of them have found proof that training hand-eye coordination can improve your abilities in sports, especially reaction time. Hand eye coordination is not only limited to sports in general but also to the activities of daily living that all people do on a daily basis. Several studies have claimed this case to be true, this is specifically shown in the study of Thulasiram et al. (2020) wherein they have stated that hand-eye coordination can be a skill needed for the basic action of grasping. To support the other half of the study which is hand-ear coordination, while being the lesser-known concept compared to hand-eye coordination the studies have shown a conclusive relationship between the eyes and the ears. While this being more of a skill pointed towards musicians, it can also be related to other motor skills as stated Further research by Boyer, et. al (2013)the result highlights effectiveness of auditory feedbackprocessing in online motor control, and they hypothesize that the auditory system uses dynamic changes in acoustic signals brought on by changes in head tilt to process online motor control.

There are a few theories relating to the sensorimotor skills of hand-eye, hand-ear, and hand-eye-ear coordination which this study is based on, namely; auditory-motor loop and visual motor integration, where each is defined by Svard (2014) they defined auditory-motor loop as “sound to movement to sound”, and by Falcy (2020) as the capacity to integrate the visual information we perceive with our motor skills in order to execute movements of our arms, legs, and body correctly is known as visual motor integration Following this, the combination of two concepts which is hand-eye-ear coordination. This concept has been supported by a few studies with mostly positive results, it helps in sports as the one stated by the study of Costantini (2016) and in the medical field, specifically in surgery as stated by Boghal et. al (2022), wherein in both cases there can be significant positive results in coordination with these concepts. Exergames have proven to be a fun and effective way to help in therapies for physical health. A study that has stood out to support the concept of exergaming is the study by Pacheco et.al (2020) wherein he has stated that. Exergaming is a fun, engaging, and interactive form of exercising that may help overcome some of the traditional exercise barriers and help improve adherence on the part of older adults, providing therapeutic applications for balance recovery and functional mobility. Exergames increase patients' motivation to continue completing balance exercises and enhance balance and mobility in older persons without neurological problems. The literature in the methodological support section will support the researchers in the approach they will take in conducting the study.

METHODOLOGY

The respondents of the study, The subject were chosen based on the following criteria: A Licensed Physical Therapist that has at least 1 year of work experience and currently working in any rehabilitation center or hospital. Either male, female or non-binary with ages 25 years old and above. Lastly, willing to participate in the study. The study used quantitative research design, specifically survey design. A minimum of thirty (30) physical therapists made up the study's respondents; they were sought out by the researchers at various hospitals and rehabilitation facilities in the cities of San Pedro, Binan, Santa Rosa and Cabuyao, in the region of Laguna. A survey questionnaire had been used as the main data-gathering instrument. The instrument to be prepared focused on answering the statement of the problem. The questionnaire contains six (6) main sections namely; design, features, ease of

use, safety, functionality, and overall acceptability with five (5) sub - questions on each of the first six (6) main questions. . The researchers will measure the acceptability of the device by letting the respondents answer a questionnaire answered by a Likert scale. The general weighted mean will be the statistical treatment used in the study.

RESULTS

Table 1 shows the gathered results in mean, ranking, and verbal interpretation of the questions in the level of acceptability based on design.

Table 1. Respondents' Level of Acceptability Based on DesignThe questions are ordered in descending order according to the acceptability level based on design

	Mean	Verbal Interpretation	Rank
1. The device has an innovative design.	4.39	Highly Acceptable	1
2. Users can participate in a variety of activities.	4.37	Highly Acceptable	2
3. I find the device easy to transport.	2.92	Acceptable	5
4. The important features are highlighted in the design.	4.21	Highly Acceptable	3
5. I find the aesthetic appearance pleasing.	4.00	Moderately Acceptable	4
Mean	3.91	Moderately Acceptable	

Table 1: Question number 1 was ranked first (4.39), followed by question number 2 (4.37), question number 4 (4.21), question number 5 (4.00), and question number 3 (2.92), bringing the total mean to 3.91.

Table 2 shows the gathered results in mean, ranking, and verbal interpretation of the questions in the level of acceptability based on features.

Table 2. Respondents' Level of Acceptability Based on Features

	Mean	Verbal Interpretation	Rank
1. I find the features of the device appropriate for hand-eye-ear coordination training.	4.29	Highly Acceptable	2
2. The concept of the device is fully captured by the features.	4.13	Moderately Acceptable	4

3. The difficulty level is appropriate for table tennis athletes.	4.08	Moderately Acceptable	5
4. I find the features appealing.	4.24	Highly Acceptable	3
5. The two modes are appropriate features for training coordination.	4.32	Highly Acceptable	1
Mean	4.21	Highly Acceptable	

Table 2: The questions are ordered in descending order according to the acceptability level based on features. Question number 5 was ranked first (4.32), followed by question number 1 (4.29), question number 4 (4.24), question number 2 (4.13), and question number 3 (4.08), bringing the total mean to 4.24.

Table 3 shows the gathered results in mean, ranking, and verbal interpretation of the questions in the level of acceptability based on ease of use.

Table 3. Respondents' Level of Acceptability Based on Ease of Use

	Mean	Verbal Interpretation	Rank
1. The device is easy to set up.	3.87	Moderately Acceptable	4.5
2. Patients can easily use the device with minimal assistance.	3.87	Moderately Acceptable	4.5
3. I find the device easy to operate.	4.34	Highly Acceptable	2
4. The purpose of the device is easy to understand.	4.47	Highly Acceptable	1
5. The device is easy to know inside out.	4.11	Moderately Acceptable	3
Mean	4.13	Moderately Acceptable	

Table 3: The questions are arranged in descending order depending on their level of acceptability based on ease of use. Question 4 was ranked first (4.47), followed by question 3 (4.34), question 5 (4.11), and questions 1 and 2 (3.87), for a total mean of 4.47. Therefore, the overall score was interpreted as moderately acceptable.

Table 4 shows the gathered results in mean, ranking, and verbal interpretation of the questions in the level of acceptability based safety.

Table 4. Respondents' Level of Acceptability Based on Safety

	Mean	Verbal Interpretation	Rank
1. The pad is safe to operate as a therapist.	4.34	Highly Acceptable	1.5
2. The pad is safe to use as a patient.	4.34	Highly Acceptable	1.5
3. The device itself is not a safety hazard.	3.71	Moderately Acceptable	5
4. The device can be safely stored in an indoor environment.	4.05	Moderately Acceptable	4
5. There is little to no risk for electrical injuries.	4.08	Moderately Acceptable	3
Mean	4.11	Moderately Acceptable	

Table 4: The questions are listed in descending order based on their level of acceptability based on safety. Question 1 and 2 were tied for first rank (4.34), followed by questions 5 (4.08), 4 (4.05), and 3 (3.71), for a total mean of 4.11.

Table 5 shows the gathered results in mean, ranking, and verbal interpretation of the questions in the level of acceptability based on functionality.

Table 5. Respondents' Level of Acceptability Based on Functionality

	Mean	Verbal Interpretation	Rank
1. The device serves the intended purpose.	4.50	Highly Acceptable	1.5
2. The device functions as intended.	4.42	Highly Acceptable	4
3. The device is able to train hand-eye coordination.	4.53	Highly Acceptable	3
4. The device is able to train hand-ear coordination.	4.00	Moderately Acceptable	5
5. The function of the device is engaging and entertaining.	4.50	Highly Acceptable	1.5
Mean	4.39	Highly Acceptable	

Table 5: The questions are ordered in descending order according to the acceptability level based on functionality. Question number 1 and 5 was ranked first (4.50), followed by

question number 3 (4.29), question number 2 (4.24), and question number 4 (4.08), bringing the total mean to 4.24.

Table 6 shows the gathered results in mean, ranking, and verbal interpretation of the questions in the level of acceptability of the device.

Table 6. Respondents' Level of Acceptability of the Device

	Mean	Verbal Interpretation	Rank
1. The DEMATERA training device is fit for training table tennis athletes.	4.24	Highly Acceptable	1
Mean	4.24	Highly Acceptable	

Table 6: The overall acceptability is interpreted as highly acceptable with all the sub-problems being factored in which tells that it can be considered for an effectiveness study in the future.

DISCUSSION

The study aimed to provide the level of acceptability of hand-eye-ear coordination training pad in table tennis athletes for physical therapists. Based on the data collected and interpreted, the results of the study are as follows: The level of acceptability in terms of design received an overall mean of 3.91 (Moderately Acceptable), in terms of features an overall mean of 4.21 (Highly Acceptable), in terms of ease of use an overall mean of 4.13 (Moderately Acceptable), in terms of safety 4.11 (Moderately Acceptable), in terms of functionality a mean of 4.39 (Highly Acceptable) and lastly the overall acceptability of the device with a mean of 4.24 (Highly Acceptable). The overall acceptability of the study is interpreted as highly acceptable with all the sub-problems being factored in which tells that it can be considered for an effectiveness study in the future. The findings are as follows: The respondents have had mostly positive responses towards the device with the verbal interpretation of the mean data ranging from acceptable to highly acceptable, hand-eye-ear coordination training is not limited to sports training—it can also be used in rehab scenarios for conditions related to coordination, DEMATERA is an easy to use device for both the Physical Therapist and the patient since the instructions are fairly simple and easy to understand, DEMATERA is a safe device with little risk for the patient, with no hazards whatsoever.

The researchers recommended the following modifications: Use a different sound system and sound bites that are more distinct and must be used instead of buzzers, add different modes to accommodate different conditions and particular athletes, maximize the vacant space on the device by adding other coordination-related activities or exercises that suit the rehab setting, add an additional feature on the hand-ear mode that the buttons may light up whenever the patient presses the correct button, add features where it can be wall mounted and lessen weight and size of the device for it to be easier to transport, improve overall structure of the device for the hand-ear coordination sounds to be easily localized.

CONCLUSIONS

1. There have been few to no respondents during implementation who are aware of any other hand-ear coordination device.
2. Hand-ear coordination is still in its infancy, with only a few people knowing about the concept.
3. The device is well received and is acceptable according to Physical Therapists.
4. The device functions as intended with the parameters it has at the moment.
5. The study is overall highly acceptable and can be continued in an effectiveness study.
6. There are still more ways to improve the study in an effectiveness study with features to add and improve upon.

ACKNOWLEDGEMENTS

The researchers would want to begin by expressing their appreciation to God for giving them the strength and determination to preserve this study's long process of implementation and research. They are also grateful for all the blessings, knowledge, and opportunities that God has provided them, which have enabled them to complete their thesis.

The researchers want to extend their gratitude to their respective families and partners, and family in supporting and guiding them all throughout their journey, not only financially but also emotionally, that aided them in completing their research.

The researchers profusely Dr. San Antonio Noel, their research adviser for accommodating us while doing our research and for his constant encouragement and guidance all throughout their research period.

Lastly, the researchers would also want to extend their sincere thanks to their faculty members, Dr. Stephanie Piol, Prof. Kenneth Facun, Prof. Jeri Buhay, and Dean John Lumagui for their valuable and innovative insights, feedback and hugely helpful suggestions that improved the research for it to be considered for publication.

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