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PROCEEDINGS

1-2 JULY 2021

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ICE-TES 2021

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FOREWORD

Message from the Rector

Honorable Keynote Speaker, Mr. Ignasius Jonan, former Minister of the Energy and Mineral Resources, and previously Minister of the Transportation Ministry of the Republic of Indonesia, we are greatly honored to have you with us this morning.

Distinguished keynote speakers, Prof. Ahmad M. Ramli (represented by Ikhsan Baidirus, S.H., LLM, Director of Post, General Directorate of Post and Information Technology, Ministry of Communication and Information Technology), Prof. John Silke, Dr. Ferry Sandra, Prof. Takayuki Arai, Prof. Young Ho Kim, Prof. Susy Tjahjani, Prof. Pim Martens, Dr. Dwinita Larasati, Prof. Chien-Hsu Chen, Prof. Wilson Bangun and Prof. Marcellia Susan, as well as all participants in the international conferences at Maranatha University.

A very good morning and best wishes to you all, and good evening to our colleagues in the US. Greetings and a warm welcome to Maranatha Christian University (MCU), Bandung, Indonesia.

I am delighted to be here with you today for the opening of the first MCU international conferences. These are: (i) The International Conference on Emerging Issues in Technology, Engineering, and Science, and (ii) The International Conference on Emerging Issues in Humanity Studies and Social Sciences, with the themes of: Digital Ecosystems for Sustainable Health and Community Development towards an Intelligent Society, and Innovations for Sustainable Community Development - Research and Practices, respectively.

We thank the many participants from countries across the different continents: the USA, the UK, the Netherlands, Norway, Taiwan, Japan, Korea, Thailand, Singapore, Malaysia, India, Australia, and New Zealand.

These first international conferences will serve as a platform to enable speakers and participants to share their research results, drawn from up-to-date research work, to initiate and strengthen further collaboration.

Without further ado, I would like to thank all the participants who have joined us for these international conferences. Again, my sincere hope is that what we accomplish today will be beneficial towards establishing collaboration among all the participants of these conferences.

I hereby declare the first international conferences at MCU in 2021 officially open.

May God bless you all. Thank you.

Prof. Ir. Sri Widiyantoro, MSc., PhD., IPU.
Rector of Maranatha Christian University

Foreword

On behalf of the committee members, it is a great pleasure to welcome you all to our first two international conferences: Emerging Issues in Technology, Engineering, and Science (ICE-TES) and, Emerging Issues in Humanity Studies and Social Sciences (ICE-HUMS).

ICE-TES and ICE-HUMS are twin events which serve our passion in balancing technology and humanity issues in the world of science and share the core values of our university: Integrity, Care & Excellence (ICE).

This year's theme for both conferences focus on the United Nations' Sustainable Development Goals (SGD), which emphasize the following aspects: ICE-TES (Digital Ecosystem for Sustainable Health & Community Development: Towards the Intelligent Society) and ICE-HUMS (Innovations for Sustainable Community Development: Research and Practices). We believe research and initiatives that has pragmatic and multidisciplinary/interdisciplinary approaches allows us to unravel fundamental problems and answer related questions regarding sustainable development.

The logistics of both of the First ICE-TES and ICE-HUMS 2021 conferences consist of two general and five-scientific keynote speakers. Special tracks are designed in each conference which cover recent developments in: ICE-TES (technologies, engineering, medical, and dentistry), ICE-HUMS (psychology, languages & cultures, economics, arts & design, and laws). The ICE-TES tracks received 82 submissions and 51 are accepted in the proceedings, involving authors from five countries, and corresponding to an acceptance rate of 62.2%. At the same time, the ICE-HUMS has received 130 submissions and 73 are accepted in the proceedings, involving authors from four countries, corresponding to an acceptance rate of 56.1%. All submitted papers were peer-reviewed on the basis of their significance, state-of-the-art contributions, and technical qualities.

Since we are still in the midst of COVID-19 pandemic, the conference has been organized virtually. The organizing committee has been working intensively to ensure that the scientific sessions will be valuable and engaging for all presenters and attendees. The parallel session format is a mix of pre-recorded and synchronous engagement through in-person live videos and question and answer sessions.

We would like to express our sincere appreciation to all the keynote speakers, committee members and reviewers for their dedication. Last, but certainly not least, we would like to offer many thanks to all authors who submitted their papers and all participants who registered to join this conference. We believe that ICE-TES and ICE-HUMS 2021 will be an inspiring academic occasion and will become a great platform for many ideas as well as research initiatives in the scientific community. Have an inspiring conference!

Dr. Hapnes Toba, M.Sc., General Chair of ICE-TES and ICE-HUMS 2021
Dr. Wahjoe Widowati, M.Si., General Co-chair of ICE-TES 2021
Joni, Ph.D., Ak., CA., CPSAK., General Co-chair of ICE-HUMS 2021

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Virtual Reality Stimulants of Motor Ability through the Virtual Reality-based Game

Erwani Merry Sartika[1][a], Novie Theresia Br. Pasaribu[1][b], Richard Setiawan[1][c], Reynaldy Felicius Gunawan[1][d], Dion Melvern Siswanto[1][e], Che-Wei Lin[2][f] and Febryan Setiawan[2][g]

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Keywords: Virtual Reality, Bilateral Movement, Alternating Movement.

Abstract: To improve the physical body, the motor function of the non-dominant hand also needs to be considered to increase productivity. Virtual Reality is widely used as a video game, but it is widely used as a means of doing physical exercise. In this research, the improvement of non-dominant motor skills through VR-based games used bilateral and alternating movement methods. The game "Rowing movements" represents the bilateral movements methods which is considered the most relevant to be implemented, while the game "Climbing" represents the alternating movements method. The game design process that is carried out is setting the VR on Unity, making the environment, making game objects, player, time display, game object position, movement of game objects. Hitbox design is also designed, with the aim of knowing the performance of the rowing game, while the performance of the climbing game uses the integral difference between the dominant and non-dominant hand climbing movements of the research subject which is scaled in a cartesian field. The results show that the use of VR stimulates user interest so that it improves motor skills if done regularly both for movement using the bilateral method and alternating movement.

1 INTRODUCTION

Hands are an important part of the human body. This is the main reason for physical or motor training on the hands to take precedence over other parts of the body. Basically, humans have one dominant hand which is used to carry out various activities. However, the motor function of the non-dominant hand also needs to be considered to increase one's productivity and quality of life. In addition, the increase in non-dominant hand motor function can also affect the dominant hand motor function to be better (Stöckel & Weigelt, 2012).

Bilateral movements are the movements of the two arms that are used together to contract the muscles, then produce a force, and then move the weight given (Fountaine, 2018). Meanwhile, the other movements are alternating movements. Alternating Movements is an activity that uses limbs alternately, one example of which is hand movements. This activity is useful for training non-dominant hand and hand motor skills (Arceneaux et al., 1997). Activities using non-dominant hands can balance hand motor skills. One way is by using non-dominant hands to do things that require proper coordination.

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Rowing is a physical activity that uses the hand as the control. The rowing simulation places the user as the rower of a boat using one paddle in each hand. Rowing activity requires both hands to move simultaneously (Bilateral Movements). While climbing is a physical activity that uses hands and moves using alternating movements as the control. Climbing is a sport that requires the body to move to the top of the rock climbing. One of the muscles that play a role when climbing is the arm muscles, because the arm muscles help to pull the body upwards. The ability to produce locomotive movements in a very short time is the result of the maximum cooperation between strength and speed. The combination of strength and speed affects the formation of power which can be seen from the results of its movement.

Virtual Reality is a technology that allows users to enter and interact in a virtual environment. In addition, Virtual Reality allows developers to manipulate virtual environments so that they can be tailored to the needs of consumers and developers (Stevens & Phillips Stoykov, 2004). Virtual Reality in its development is widely used as a video game. But along with its development, Virtual Reality is also used as a means of doing physical training (Okechukwu & Udoka, 2011). One of them is hand motor training, this is because Virtual Reality can be combined with additional tools such as controllers / joysticks that allow users to perform various variations of movement. In addition, the sensors / buttons on the controller / joystick can maximize user accessibility so that users can make movements or interact with visual objects in the Virtual Reality environment. (Stevens & Phillips Stoykov, 2004).

Based on these reasons, a simulation using Virtual Reality will be realized using the bilateral movements and alternating movements method so that data can be collected to prove that the use of Virtual Reality by using these two methods can improve the dominant and non-dominant hand motor skills in humans.

The purpose of this research is to determine the influence of bilateral movement methods and alternating movements in simulations using Virtual Reality on improved motor capabilities in non-dominant hands. Simulation creation using Unity software. Simulation is created in the form of Virtual Reality, design, and implementation of simulations in three dimensions. The simulation designed is a simulation of a Rowing Game (bilateral movement) and a Climbing Game (alternating movement).

2 METHODS

The method used in this research consists of library review to find out the definition and type of game that is right to be applied. Furthermore, the game design steps are made to make it happen. Analysis of realization results is discussed in results and discussion.

2.1 Bilateral Movement Method

Bilateral movements are the movements of both arms that are used together to contract muscles, then produce force, and then move the weight exerted (Fountaine, 2018). Bilateral Movements provide an easier understanding of movement for people who are undergoing recovery. When both hands are moved together, the tendency towards synchronization between arms will be stronger, which is the need to focus on moving both hands much less. In this way, bilateral movements provide greater possibilities to produce an interpretation of movement that will be easier to understand by the motor compared to when driven separately (Stevens & Phillips Stoykov, 2004).

Bilateral hand training, compared to unilateral training or other forms of mobility training, shows more significant development for patients with chronic and acute hemiparesis. However, this bilateral hand training activity did not show any more significant and effective development for hemiplegia sufferers(Stevens & Phillips Stoykov, 2004).

Rowing Movements are movements performed continuously, requiring aerobic or anaerobic power. The drive phase cycle in rowing starts when the rowers push with their legs then then pull their lower arms and backs sequentially. These movements also require muscle strength and endurance(Conde et al., 2005). The cycle of movement can be seen in the Figure 1.

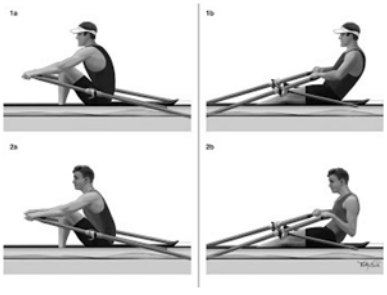


Figure 1: Rowing Movements.

Rowing movement is one of the movements that uses the bilateral movement method which is considered the most relevant to be applied in this

research. This is due to a movement pattern that requires both hands or arms to be moved simultaneously and which is later used to improve the motor skills of the non-dominant or impaired hand.

2.1.1 Design Game Rowing

In this research, bilateral movement simulation is implemented in Rowing Game. The Rowing Game Design Block Diagram can be seen in Figure 2. The design process starts from tuning the virtual reality gear and then designing the environment which consists of creating terrain and detailing tree and rock objects. After that, it is continued with the design of the boat object in which there is a camera and player controller. Next, a hitbox is designed which will be attached to the boat. The objective design is carried out after the environment and boat objects have been created. Objective consists of objects coins and finish area. The final part is designing the User Interface which consists of a timer, starting countdown, coin counter, and Game over Panel. The design process diagram can be seen in Figure 2.

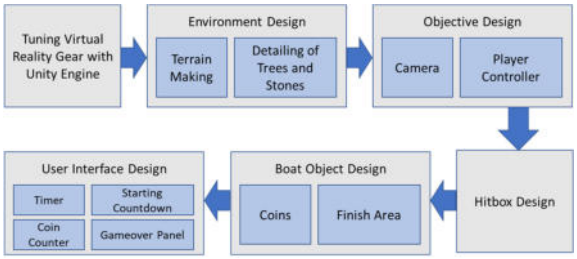


Figure 2: Rowing Game Design Block Diagram.

2.2 Alternating Movement Method

The ability to be able to use both hands is referred to as bilateral coordination. Bilateral coordination includes 2 types of movements, namely simultaneous movements, and alternating movements. Good bilateral coordination of the hands is demonstrated by the balance in both rough motor movements of the hands.

The alternating movements used in this simulation are climbing movements. In addition to its alternating and repetitive movements, this movement allows researchers to compare the movement between non-dominant hands and the dominant hands of each research subject to be known whether alternating movements affect the motor ability of non-dominant hands.

Alternating movements are also used as a method to detect coordination disturbances, this coordination disorder is indicated by an imbalance of the results of movement of both hands when performed alternately (Fimbel et al., 2005). Alternating movements can also be applied to climbing or climbing movements. Climbing is a branch of sports that requires the body to move towards the top of the climbing stone. One of the muscles that plays a role at the time of climbing is the arm muscles, because the arm muscles help to pull the body towards the top. The ability to produce explosive movements in a very short period is the result of maximum cooperation between strength and speed. The combination of strength and speed affects the formation of power that can be seen from the results of its movement. The success of climbing results is determined by the consistency of the results of arm muscle movements when climbing. The climbing movement can be seen in Figure 3.

Figure 3: Rock Climbing Activity.

2.2.1 Design Game Climbing

In this research, the simulation of alternating movement is implemented in the Climbing Game. The Climbing Game Design Block Diagram can be seen in Figure 4. In this research, Unity was used to create simulations with Virtual Reality that demonstrated an alternating motion or alternating movements. Using Virtual Reality in the Unity project requires an Oculus Rift controller, so it is necessary to install the driver first. In this climbing simulation project, several Game Objects are needed such as environment, climbing stones (climbpoint), player, and time display. Positioning is required in the process of placing the Game Object that was previously created. Scripting is then performed to manipulate the Game Object to act as desired. There are 3 main scripts in the design of climbing simulations, namely the Climbing Motion script (Pull), Gravity (Gravity), and Timer (Timer).

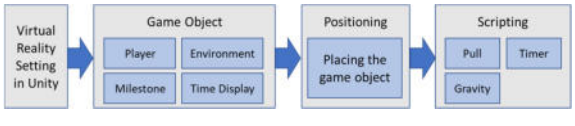
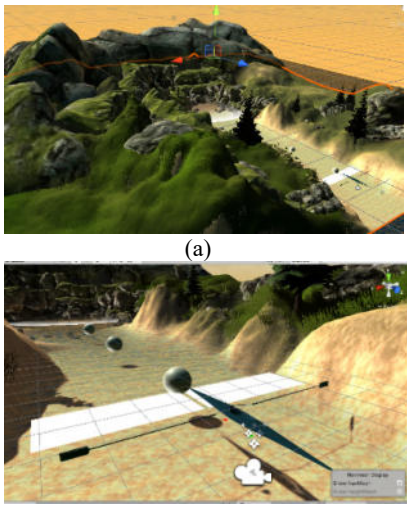


Figure 4: Climbing Game Process Design Diagram.

3 RESULTS AND DISCUSSION

3.1 Bilateral Movements Results

The following is a display of the unity program for Bilateral Movement (Figure 5). In this rowing simulation, the designed environment is a mountainous environment in which there are rocks, hills, mountains, trees, and a river. This rowing simulation environment can be seen in Figure 5. The boat object functions as a player which is the main object that will interact directly with the user. A special camera is mounted on the boat object for virtual reality simulation which will be connected directly to the Oculus Rift or Google Virtual Reality which is used by the user to view the Virtual world in real-time.



(a)

(b)

Figure 5: Display of the Unity Program for Bilateral Movement (a) Environment Display, (b) Boat Object Display.

From the simulations that have been created, testing was conducted with test data taken from 3 research subjects. Data retrieval is done for 1 day. The research subjects filled out the survey first before conducting the experiment. Each subject is given 15 minutes to learn to use the provided virtual reality gear. Each subject experimented 3 times, with a 10-second time lag between experiments.

The initial conditions of the boat object when tested are as follows. The position on the x-axis is -107.06, the position on the y-axis is -0.824, the position on the z axis is 28.5. The first experiment is conducted 3 times and each experiment will be observed and retrieved data. The data taken is the completion time, the number of rowing subjects, the trajectory traveled, and the number of coins collected.

In the first attempt, the first user was able to complete the simulation in 22.17 seconds with 33 paddling and managed to collect 3 out of 3 coins. Figure 6 is the trajectory the subject took in experiment 1. Table 1 is the data of experimental observation 1 for the distance of each paddle touch point with the water surface against the boat.

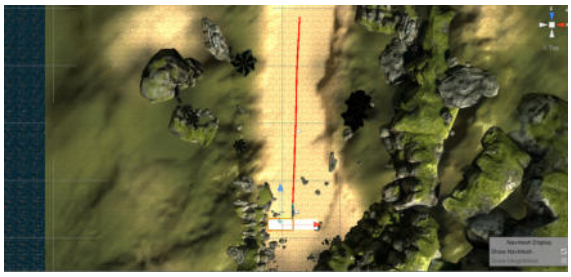


Figure 6: Simulation Design Process.

The experiment was conducted on 3 research subjects. Based on the test results obtained, it can be concluded that there is an improvement in the performance of non-dominant hands using bilateral movement methods. This can be proven by the results of observation data on 3 research subjects who showed a smaller error value in each experiment, the error value is the result of a reduction of the amount of distance of each paddle touch point with the surface of the water against the boat on the left and right hand.

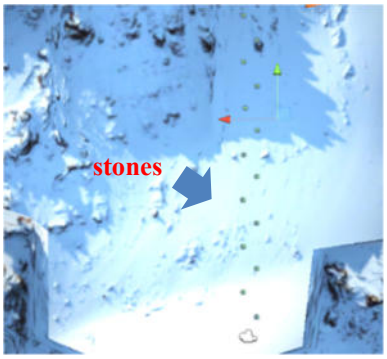
The test results also prove that the research subjects's understanding of virtual reality gear is directly proportional to the research subjects's performance when conducting rowing simulations using virtual reality. In Table 1, the first subject conducts an experiment and is observed, and the data is taken in the form of completion time, trajectory traversed, and the number of coins that have been collected. The first subject can complete the simulation in 33 paddles and successfully collect all the coins.

Table 1: The First Research Subjects Data Experiment 1.

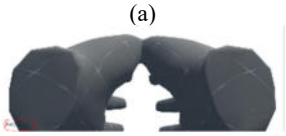
Left Point	Right Point	Difference Between Point
2,899347	-2,905545	-0,006198
2,699359	-2,641025	0,058334
2,673499	-2,565061	0,108438
2,575044	-2,555524	0,01952
2,618853	-2,612459	0,006394
2,654607	-2,708993	-0,054386
2,636998	-2,700497	-0,063499
2,702779	-2,700497	0,002282
2,715405	-2,637317	0,078088
2,684289	-2,66491	0,019379
2,757622	-2,630151	0,127471
2,621608	-2,630597	-0,008989
2,661496	-2,63454	0,026956
2,661496	-2,626003	0,035493
2,652396	-2,583199	0,069197
2,641745	-2,658282	-0,016537
2,672914	-2,582476	0,090438
2,652409	-2,634614	0,017795
2,620956	-2,629205	-0,008249
2,683	-2,629205	0,053795
2,67047	-2,672936	-0,002466
2,775788	-2,566797	0,208991
2,635197	-2,552659	0,082538
2,644223	-2,59359	0,050633
2,640778	-2,627459	0,013319
2,677565	-2,611967	0,065598
2,632084	-2,621306	0,010778
2,741297	-2,729553	0,011744
2,769871	-2,683123	0,086748
2,681472	-2,641546	0,039926
2,681472	-2,641546	0,039926
2,666943	-2,55028	0,116663
2,547802	-2,966956	-0,419154
Sum of the distance from the left point to the center of the boat	**Sum of the distance from the right point to the center of the boat**	**Total**
88,250784	**87,389818**	**0,860966**
Difference between the number of left and right points		**Number of paddle subject**
0,860966		**33**

3.2 Alternating Movement Results

The following is a display of the unity program for Alternating Movement (Figure 7). In this research, the climbing path is arranged equally between the left hand and the right hand so that the movement between the left hand and the right hand can be compared. The number of climbing stones used are 22 stones (11 stones for the left side and 11 stones for the right side). The X-axis distance can be adjusted and adjusted so that the paths do not overlap each other, in this research the width between the lines is spaced 0.7 (X-axis). The same is done for the Y axis, namely the distance between the first stone and the next stone. After the cliff position and rock climbing have been positioned, the result will be as shown in Figure 7.



(a)



(b)

Figure 7: Display of the Unity Program for Alternating Movement, (a) Display of Environment, (b) Display of Subject's Hands

Before conducting the simulation, research subjects were asked to fill out a questionnaire that had been made. Based on the results of the questionnaire, the research subjects were divided into 3 categories, namely:

- One man who used VR.
- Two men who have never used VR.
- Two women who have never used VR.

The five research subjects had the same age range, namely 21-25 years. The five of them also had never experienced rock climbing and were right-handed. After filling out the questionnaire, subjects were given 10 minutes to get used to using the VR Controller. After that, the subject is allowed to do a simulation so that data can be collected. In the data collection process, the data taken are:

- The results of the dominant and non-dominant hand climbing movements of the research subject.
- Travel time of research subjects in completing the simulation.
- The distance traveled by the research subject in completing the simulation.

The simulation is said to be complete if:

- Research subjects can climb to the last rock.
- Research subjects fail to climb or fall in the simulation.

Data collection was carried out 2 times a day for 5 days. Each time the data was collected, the subject was given time to rest for 10 minutes to ensure that the research subject did not experience fatigue for the next data collection due to the previous data collection. Subject research was tried on 5 research

subjects. The result of dominant and non-dominant hand climbing movement is scaled on a cartesian field that has been made to be known the extent of deviation that occurs in the hand movements of the research subjects. To find the area of deviation is used Reimann integral method written as in Equation (1).

$$L = L_0 + L_1 + + \cdots + L_n$$
$$L = f(x_0)\Delta x_0 + f(x_1)\Delta x_1 + \cdots + f(x_n)\Delta x_n \quad (1)$$

$f(x_n)$ is the value when point n, and Δx_n is the distance of each change between sample point 1 to the next sample point. In this data the value $f(x_n)$ is the position magnitude value of x the sample point.

The first subject is the first female subject who has never used VR. Table 2 is the data on the area of hand movement deviation for the first subject, and Table 3 is the observation data for the first subject.

Table 2: Hand Movement Deviation in the First Subject.

Area	Data 1		Data 2		Data 3		Data 4		Data 5	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
1	14	57	77	152	0	331	20	113	8	28
2	24	30	49	33	28	206	42	55	28	242
3	69	87	57	172	84	477	54	156	23	37
4	55	60	37	146	39	194	39	194	42	87
5	13	26	8	74	8	390	1	138	0	26
6						21	88	45	19	152
7							293	140	22	6
8							0	11		
9							10			
10										
11										
12										
13										
14										
Avg	35	52	45,6	115,4	45,6	115,4	45,6	115,4	45,6	115,4

Area	Data 6		Data 7		Data 8		Data 9		Data 10	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
1	100	112	43	114	56	45	17	61	25	101
2	52	32	147	91	0	103	0	36	1	43
3	152	69	295	165	43	161	17	76	52	47
4	7	19	185	17	5	62	53	63	7	7
5	5	24	177	99	13	96	30	91	0	54
6	243	12	0	84	48	145	14	33	9	53
7	239	49	13	157	4	49	54	50	69	82
8			27	7	56	11	96	45	61	126
9					36	55	10		68	154
10					104	99			63	57
11					14	6			186	328
12									36	67
13									194	380
14									63	12
Avg	114	45,3	110,9	91,8	34,5	75,6	32,3	56,9	59,6	107,9

Table 3: Observation Data on The First Subject

Data	Distance Limit	Time	Time difference to Distance
1	2,3	22	4,78
2	2,3	18	3,91
3	2,6	23	4,42
4	4,2	44	5,24
5	3,5	30	4,29
6	3,7	34	4,59
7	3,7	32	4,32
8	5,1	34	3,33
9	4,1	38	4,63
10	6,9	45	3,26

Based on observational data in Table 2 and Table 3, the first subject showed that the movement of the right hand is better than the movement of the left hand, this can be seen from the area of deviation formed from the right hand is smaller than the left hand, which is an average difference of 49.8. The first user also showed an improvement in the ability of the left-hand judging by the decrease in deviation area formed from experiment 1 to experiment 10. The research subjects showed an increase in the distance that could be traveled in each data collection. This shows the effect of using VR which is getting better if it is done regularly.

Table 4: Observation data from Research Subjects.

Data	First Subject (women)*			Second Subject (women)*		
	Right	Left	Difference	Right	Left	Difference
1	35	52	17	70,6	24	46,6
2	45,6	115,4	69,8	54,2	72,4	18,2
3	45,6	115,4	69,8	42,8	57,6	14,8
4	45,6	115,4	69,8	81,1	94,6	13,5
5	45,6	115,4	69,8	64,3	69,3	5
6	114	45,3	68,7	82,5	107	24,5
7	110,9	91,8	19,1	70,3	58,8	11,5
8	34,5	75,6	41,1	43,9	45,1	1,2
9	32,3	56,9	24,6	93,2	93,9	0,7
10	59,6	107,9	48,3	60,3	71,7	11,4
Average	56,87	89,11	49,8	66,32	69,44	14,74

Data	Third Subject (men)*			Fourth Subject (men) *			Fifth Subject (men)		
	Right	Left	Difference	Right	Left	Difference	Right	Left	Difference
1	99,5	158,7	59,2	87	68,7	18,3	123,1	104	19,1
2	72,7	61,3	11,4	16,3	95,4	79,1	77	94	17
3	54,4	64,3	9,9	64	161,2	97,2	87,5	128,7	41,2
4	88,9	154,6	65,7	52,4	110,3	57,9	48,2	71,1	22,9
5	66,9	109,9	43	54,7	58,3	3,6	49,4	49,1	0,3
6	66,3	62,1	4,2	65,8	68,5	2,7	36,7	66,4	29,7
7	64	61,9	2,1	84,5	170,9	86,4	37,4	42,3	4,9
8	59,8	44,3	15,5	54,5	74,8	20,3	62,9	65,3	2,4
9	77,6	49,1	28,5	84,1	67,8	16,3	47,8	51,1	3,3
10	74,2	123,2	49	71,4	168,1	96,7	50	64,7	14,7
Average	72,43	88,94	28,85	63,47	104,4	47,85	62	73,67	15,55

Table 4 shows that of the 5 research subjects, it can be concluded that the dominant hand has better movement than the non-dominant hand. This is evidenced by the deviation area formed by the dominant hand is smaller than the non-dominant hand. The fifth subject has already used VR, showing a stable difference between the area reached by the left and right hands. This shows that stimulants using periodic VR can help the performance of both hands, even the left-hand ability is more like the right-hand ability.

4 CONCLUSIONS

The improvement of non-dominant hand performance using bilateral movement method. This can be proven by the results of observation data on 3 research subjects (the number of research subject is limited due to the covid-19 pandemic condition) who showed a smaller error value in each experiment, the error value is the result of a reduction of the amount of distance of each paddle touch point with the surface of the water against the boat on the left and right hand. The test results also prove that the subject's understanding of virtual reality is directly proportional to the subject's performance when conducting rowing simulations using virtual reality.

In the use of alternating movements, subjects with slower climbing speeds tend to have balanced movement. This is indicated by a small difference in deviation between dominant and non-dominant hand movements. The influence of VR usage is getting better if done periodically. Men tend to learn more about VR than women. This can be seen with a rapid increase in the distance traveled when conducting simulations, with an average increase in men of 7.11 and women of 4.38. Subjects with slower climbing speeds tend to have balanced movement. This is indicated by a small difference in deviation between dominant and non-dominant hand movements.

From this research, it can be concluded that both games using VR can be used to stimulate the performance of both hands by using bilateral and alternating movements. There is an increase in the ability of the non-dominant hand getting closer to the ability of the dominant hand in both games.

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