ELEMENTARY *Islamic Teacher Journal*
E-ISSN : 2503-0256 / ISSN : 2355-0155
Volume 12 Number 1 January - June 2024 (PP. 193-212)
http://dx.doi.org/10.21043/elementary.v12i1.29635
Diakses di : http://journal.iainkudus.ac.id/index.php/elementary

Digilin-T Innovation for Madrasah Ibtidaiyah Education: Developing Software and Hardware Agility Based on Infrared Photodiode Sensors

Adi Wijayanto[1*], Muhamad Zaini[2], Mona Refaat Taman[3], Raveenthiran Vivekanantharasa[4]

[1,2]Universitas Islam Negeri Sayyid Ali Rahmatullah Tulungagung, Indonesia, [2]Alexandria University, Egypt, [3]The Open University of Sri Lanka, Sri Lanka

**corresponding author : wijayantoadi@yahoo.com*

Abstract

Agility measurements in elementary schools are often neither too thorough nor too careful in their observations, so that the child being measured may gain an advantage or even a disadvantage. There are of the fields of testing, measuring and evaluating sports fitness components is agility, which really needs a touch of information technology to help overcome and solve problems that arise in these developments, one of which is the development of computer software and hardware. With the existence of agility tests, measurements and evaluations, it is hoped that the agility scores obtained will be more objective because they avoid measurement errors made by testers. Based on these problems, the author formulates the problem: 1) What is the Range of Sports Agility Norms for the Student Body at PTKIN?; 2) What is the Software and Hardware Development Model for the Digital Agility-T [Digilin-T] Evaluation Test for Students at PTKIN Based on the Infrared Photodiode Sensor?; 3) How effective is the Student Agility-T [Digilin-T] product at PTKIN based on the Infrared Photodiode Sensor for Increasing Sports Agility for PTKIN Students? This research design uses a research and development design. The process that must be followed in development research goes through several stages including (1) initial needs analysis (need assessment) and gathering information; (2) Planning; (3) Product development; (4) Preparation for small group trials; (5) First product revision; (6) Field trials; (7) Second product revision; (8) Field trials; (9) Third product revision; (10) Dissemination and Implementation. The agility results in the small group trial of the ability to carry out agility tests and measurements using DigilinT were 60.00%. because the operational method is not yet user friendly and there are still many commands that are confusing. The use of Digilin-T in large group trials has improved. The use of DigilinT Software and Hardware in large group trials has shown increasingly better capabilities. This can be seen in general that the level of ability in operating DigilinT is very high. The level of ease of assembling for respondents reached 77.10%, components for turning on and operating the DigilinT were 93.13%. Thus, the Digilin-T as a whole can be used by testers and testees because it is easy to assemble, operate, conduct agility tests and even read the results of agility tests using the Digilin-T.

Keywords: *Agility, fitness;, infrared, photodiode*

INTRODUCTION

The slogan of Indonesian government is Superior Human Resources (HR) for Advanced Indonesia (BRIN, 2024). These superior human resources must be implemented in all lines of people's lives, including the world of education, moreover today's technological developments are very fast in quality and quantity. The development of digital technology in the form of software and hardware in the 4.0 industrial revolution era should have penetrated the world of education to assist education actors in improving the quality of human movement, for preventing health problems as well as for tests, measurements and evaluations. One of the fields of test, measurement and evaluation of sports fitness components is agility which really needs a touch of information technology to help overcome and solve problems that arise in these developments, one of which is the development of computer software and hardware. With the test, measurement and evaluation of agility, it is hoped that the agility value obtained will be more objective because it avoids measurement errors made by the tester.

The problem in the field is that we have not been able to detect fitness, especially agility, as early as possible so far (Ramadhan et all, 2022: 295). Even at the higher education level, we also do not know the fitness level of students and lecturers. From the initial survey, it was found that 87.11% of students did not understand their fitness level, especially their agility. Meanwhile, how to do agility so far for them was 81.10%. When someone does not know their fitness level, they are very susceptible to being exposed to the virus, especially when someone is less compliant with health protocols (prokes) and often ignores these prokes. Often they only realize that they have been exposed to a declining health condition. Field data on the fitness of both education personnel, educators and students and other stakeholders in higher education are urgently needed. At least in one month they can obtain data on their fitness level.

One of the advantages that must be achieved is in the field of sports achievement, but tests, measurements and evaluations of agility in supporting sports achievement and to detect fitness in students have received less serious attention, especially attention in terms of technology, both software and hardware.Tests, measurements and evaluations of sports agility in PTKI students still use conventional and manual methods. Based on the problems above, in the era of disruption 4.0 there is a need to have tools for measuring agility of body movements that are effective and efficient using information technology assistance in the form of software and hardware. Information technology approach used in measuring agility using a microcontroller. Agility is a movement that involves footwork and rapid changes in body position. To be able to provide quality and quality results, an athlete needs good agility in himself which will affect performance during training so as to improve athlete performance by involving dominant limbs such as muscles and joints. The usefulness of Digilin-T Software and Hardware Based on Infrared Photodiode Sensors is to be used by testors to record every score obtained by students/ athletes/ testees and display them up to date or directly when giving the scores, so that all lecturers/testors, assistants Athletes, coaches and spectators can find out directly on the Digilin-T board based on the Infrared Photodiode Sensor which has been installed in seven segment form. Apart from that, D igilin-T Based on Infrared Photodiode Sensors can require only one testor even though many students are tested at the same time and place. [Digilin-T] Based on this Infrared Photodiode Sensor, it can be used in all tests that require Agility Test instruments using the T Test, whether used by universities, high schools/Madrasah Aliyah, junior high schools/Madrasah Tsanawiyah, elementary schools/madrasah ibtidaiyah , as well as sports clubs and military institutions.

Based on these problems, the author formulates the problem: 1) What is the Range of Sports Agility Norms for the Student Body at PTKIN?; 2) What is the Software and Hardware Development Model for the Digital Agility-T [Digilin-T] Evaluation Test for Students at PTKIN Based on the Infrared Photodiode Sensor?; 3) How effective is the Student Agility-T [Digilin-T] product at PTKIN based on the Infrared Photodiode Sensor for Increasing Sports Agility for PTKIN Students? The goal of this research is to design and create Software and Hardware for Student Digital Agility-T [Digilin-T] Evaluation Tests at PTKIN Based on Infrared Photodiode Sensors. Development at this stage is to create a scenario script for creating Digilin-T software and hardware. Based on the data from the needs analysis, the prototype and product specifications for the Digilin-T hardware software will be known. The next stage is the creation of Digilin-T hardware software based on the Infrared Photodiode Sensor. The stages carried out in this research and development activity consist of preparation for development activities, product development, expert validation, small and large group product trials, product revisions, and product studies. revised. The final output of this research is a PTKIN student agility test tool based on an Infrared Photodiode Sensor with physical form in the form of hardware.

The research conducted by Gumantan and Mahfud (2020: 54) created the design of the Bomerang Run Test Agility Method used in Research and Development from Borg and Gall. The subjects of this study were students of sports education at the University of Teknokrat Indonesia, a model that had been evaluated by experts, tested and revised and validated by media experts, materials and practitioners through a questionnaire consisting of various questions. The effectiveness of the product development of the agility measuring instrument had results of 85% material experts, 96% media experts and 85% by practitioners.

Software or often referred to as software is a collection of data in electronic or digital form with the aim of executing a command in the form of machine language by passing through several storage, processing and procedural flows controlled by a computer or by an electronic circuit infrastructure characterized by interactions between components. the. Research on software quality is as old as software construction and concern for product quality emerges with error-free program design and efficiency during use (Miguel et all, 2014: 31). Hardware is a physical component that can be touched and arranged into a series of inputs, process circuits and output circuits that form a computer so that the computer system can be operated. Each piece of hardware has a specific function and is mutually integrated between one piece of hardware and another with the same goal of supporting computer performance (Raven et all, 2016: 56)

Agility is a sub-fitness, where agility is defined as a series of separate tasks strung together to form what is called a serial task. As such, athletes must be able to combine the various movement patterns discussed in this section in the right order and at the right time while accelerating, decelerating, and transitioning in different directions (Dawes and Roozen, 2012: 15). The same principles of positioning and body mechanics that are emphasized during power movements, such as performing explosive movements or linear velocity work, are also important when generating explosive forces in changes of direction. As such, the driving force generated through extension of the three is essential for optimal agility performance.

An Infrared (IR) sensor is basically a device consisting of a pair of IR LEDs and a photodiode, which are collectively referred to as a photocoupler or optocoupler. IR LEDs emit IR radiation whose reception intensity and/or reception from the photodiode determines the output of the sensor. Infrared sensors are electronic devices that transmit to capture some aspect of the environment. IR sensors can measure the heat of an object and detect its movement. This type of sensor only measures infrared radiation rather than being called a passive IR sensor. Typically, all objects in the infrared range emit a form of thermal radiation. This type of radiation is invisible to our eyes and can be detected by infrared sensors.

DigilinT is a digital test tool that is completely newly created, the test tool combines two scientific elements, namely sports science and informatics engineering. The tool is specifically designed to determine the results of agility and running speed by passing through infrared photodiode sensors with a total of 6 sensor points. These sensors will send the detection results to the master control unit to be processed and displayed in the form of sevent segment and LCD display. This is what makes DigilinT unique where agility test tools so far only use cones and with the help of a stopwatch, DigilinT presents the ease of agility testing by utilizing information technology in the form of photodiode sensors connected to a microcontroller packaged in the master control unit.

METHODS

This research uses a RnD (research and developmental) design for positive innovation which refers to the theory of Borg and Gall with ten stages that must be passed. Overall research on making software and hardware Diglin-T to improve agility in PTKI students based on infrare photodiode. The process that must be passed in development research goes through several stages including (1) Need assessment; (2) Planning; (3) Product development; (4) Expert Judgement; (5) First product revision; (6) Small group experiment; (7) Second product revision; (8) Large group experiment; (9) Third product revision; (10) Dissemination and Implementation.

Expert Judgment consists of 2 experts, 1) three experts in the field of sports science, and 2) three experts in the field of electronics or information and communication technology. Small group experiments are to test the developed product. The small group trial sample consisted of 12 male and 28 female PGMI students (UIN SATU Tulungagung), The large group sample was a group of PTKI UIN MALIKI Malang students consisting of 20 males and 48 females and IAIN Kediri students majoring in PGMI with a total of 14 males and 49 females, while all testers were lecturers in physical education, health, and sports study programs of PGMI at each campus.

RESULTS AND DISCUSSION

Need assessment is the first step that must be carried out in identifying problems and solving problems to support the next step in preparing the software and hardware to be produced. The component regarding understanding of agility can be explained from the picture above, the graph shows that respondents answered that they really understand as much as 17.24%, while the largest answer was quite understand 39.08%, while respondents who answered did not understand were 22.99% and Those who answered they didn't understand were 20.69%. This is because students generally understand the basic material of fitness, especially agility. It can be generalized that they have received agility material during their previous education, whether from SMA, SMK or MA.

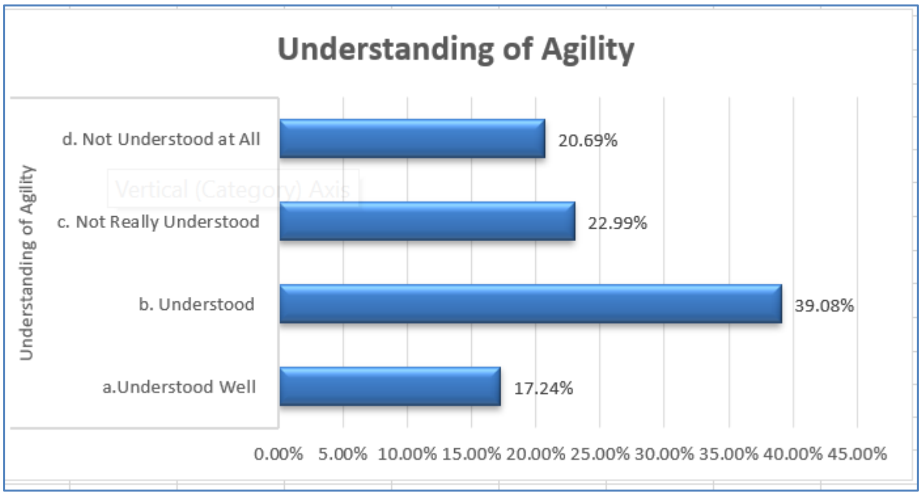

Figure 1. Level of Understanding of Agility

The use of Manual Agility Tests and Measurements is very less done by respondents, this may be due to the fact that they were given less learning practice and a variety of tests and agility measurements when they were in high school and the equivalent level. It can be seen from the following graph that 44.83% of respondents said that there was a lack of use of tests and measurements carried out manually, 34.48% said they often, and 13.79% of respondents said they often, while 6.9% of respondents said they did not Have ever carried out manual agility tests and measurements.

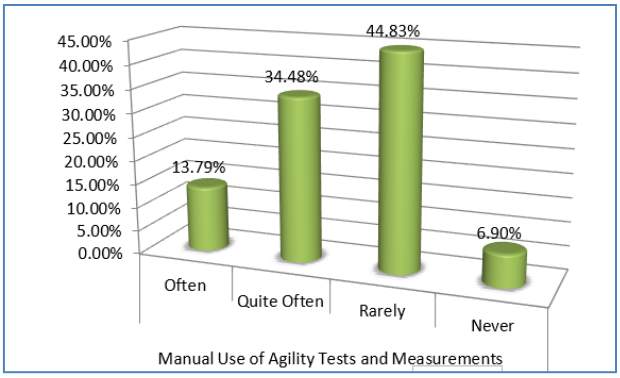

Figure 2. Manual Use of Agility Tests and Measurements

The need for technology is very necessary, especially the implementation of agility tests and measurements, as in the picture it is explained that as many as 35.63% of respondents stated that technology was really needed in agility tests and measurements, another 32.18% of respondents stated that technology was needed in agility tests and measurements, 29 .89% stated that it was not needed, and 2.3% of respondents stated that technology was not needed in the agility tests and measurements. This is because technology can make it easier and even helpful in carrying out tests and measuring children's body agility, besides that with technology, the assessments carried out will be more objective in the sense of measuring what should be measured and reducing fraudulent practices in carrying out tests and measurements of body agility. . Test results using technology are expected to be able to measure up to two digits after the comma, so that children's scores vary greatly.

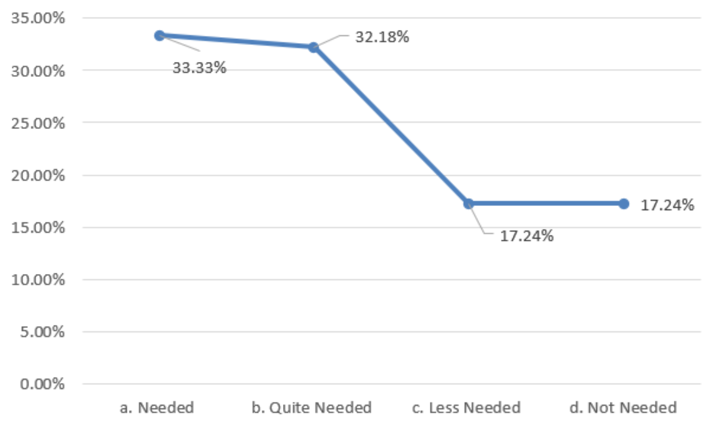

Figure 3. Analysis of technology needs in sports

Almost the same as the previous graph, analysis of the need for automatic digitalization is very necessary in agility tests and measurements. From the data obtained, it is clear that 33.33% of respondents stated that it is very necessary to create automatic agility system software and hardware to support determining a person's level of agility. 32.18% of respondents said it was necessary and 17.24% said it was not necessary to create an automatic agility test, while 17.14% said it was not necessary. From this data, it shows overall that there is a need for developing tests and measurements to be made digitally automated. Apart from being automatic, these tests and measurements must also contain digital data, this is confirmed by several answers from the questionnaires distributed.

From the data above, it is very necessary to create agility software and hardware. Through the use of agility software and hardware, we can reduce the level of errors both made by students and lecturers in carrying out agility tests and measurements. Apart from that, to maintain transparency regarding the scores obtained in tests and agility measurements which are actually displayed on the monitor directly and can be known by anyone without any hidden data. Apart from that, by creating agility software and hardware, it is hoped that it can save time in carrying out agility tests and measurements and be on time so that the implementation of agility tests and measurements runs effectively and efficiently.

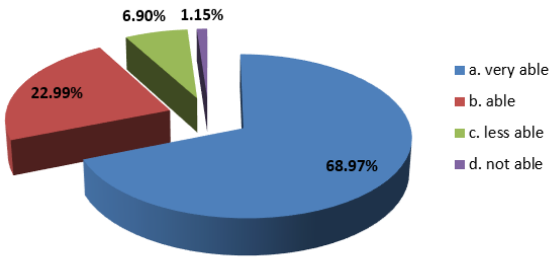

Figure 4. Level of need for agility test automation and agility digitalization.

The final data is data that explains the ability to use agility hardware software. As many as 68.97% of respondents were very able to use agility software and hardware, 22.99% said they were able, 6.9 were less able and only 1.15% of respondents said they were not able. This indicates that respondents really hope to use the device to help test and measure agility, especially dynamic agility in the T shape. Based on the results of the needs analysis, further discussion is carried out by development partners. Discussions were carried out in order to compile software and hardware scripts for Hexagonal Obstacle Microcontroller-Based Fitness Evaluation and the preparation of Level 2 Data Flow Diagrams, Databases, Entity Relationalship Diagrams, Relational Tables, Flocharts and Dependency Diagrams. Context diagrams explain the relationship between the main system and its environment or entities in simple terms. In the Context Diagram there is only one process, namely the Digilin-T Software process. While the entities consist of Administrators, Testors, Lecturers, and Testi/Students.

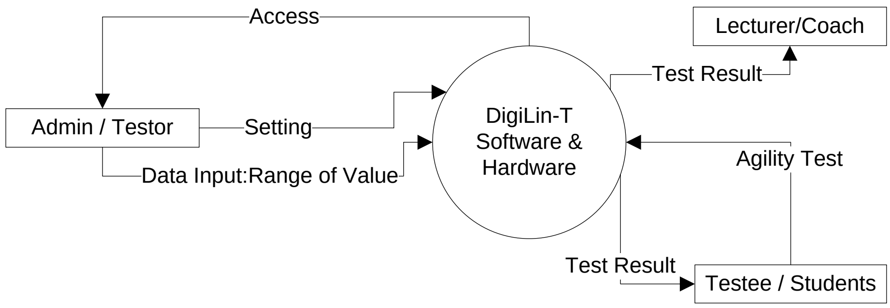

Figure 5. Context Diagram

The flowchart created functions to assist the workflow of the Digili-T hardware, with this flowchart the process steps are detailed and complete as a means of communication and documentation.

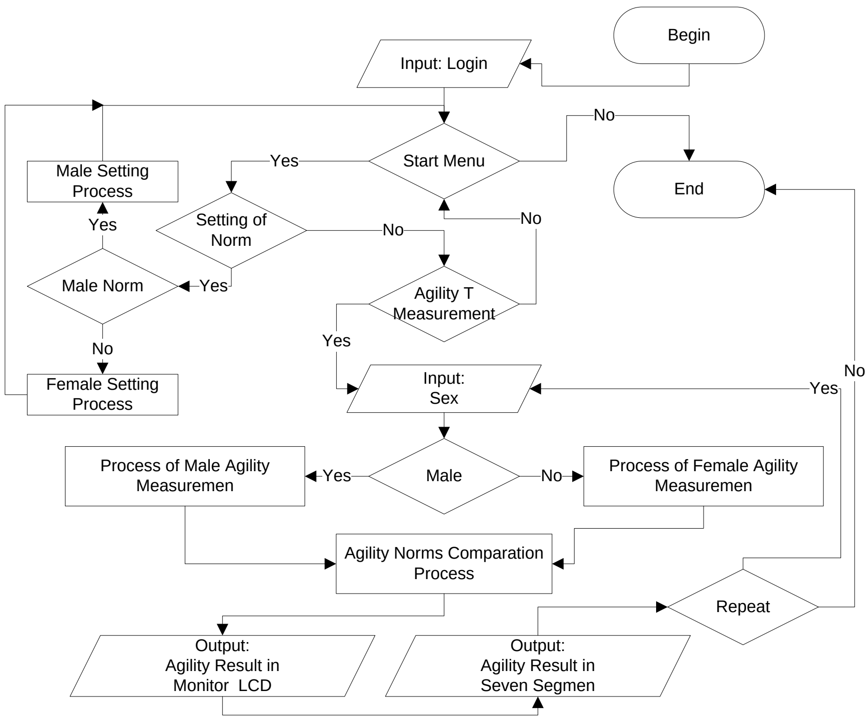

Figure 6. Digilint-T flowchart

The initial product design of agility software and hardware uses a microcontroller and with the help of an integrated infrared photodiode to produce an initial prototype. The Protel For Windows 1.5 application is used to create and design a printed circuit board (PCB) display path in a computer.

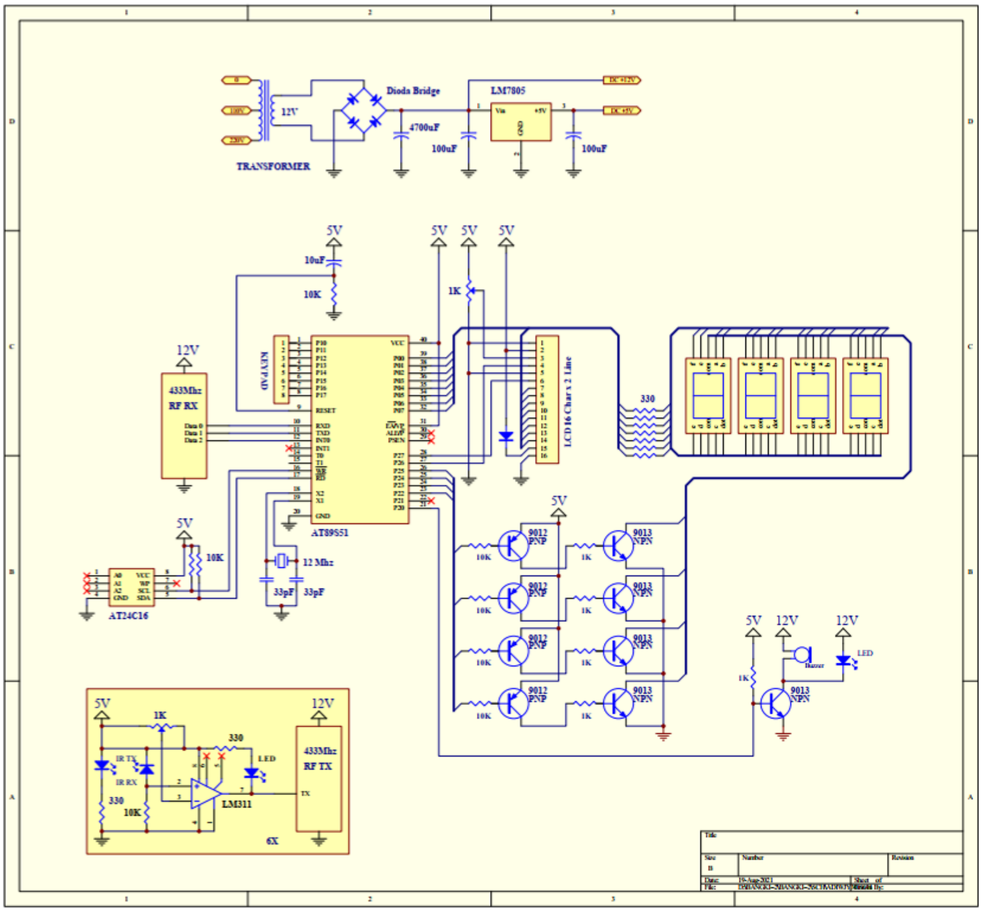

Figure 7. Schematic series of Digilin-T

Finished hardware cannot be run when there is no software that acts as the brain in carrying out commands. For this reason, coding is required in a programming language so that the computer or hardware can process data according to what the user wants, the programming language used in this research is assembly language. The microcontroller user interface uses an electrical box measuring 10 cm long, 5 cm wide and 15 cm high which consists of several number buttons (0 to 9) and the CAN (cancel) command button to cancel commands, the green Enter (ENT) button to carry out commands, the COR button is used for the correction button, and the Up Arrow and Down Arrow (Up and Down) buttons for navigation options, and the MEN button to find out whether sensors number 1 to 6 are functioning properly. In the electrical box there is also an LCD display with a size of 16x2 in the form of seven segments to display all information and results or data in the microcontroller.

Meanwhile, the sending and receiving sensors use a box with dimensions of 10 cm long, 5 cm wide and 8 cm high. The sensor box is equipped with an antenna for sending data to the master control. The box is modified to obtain the position where the sensor is attached by drilling the part in such a way that it can function as a signal sending and receiving device.

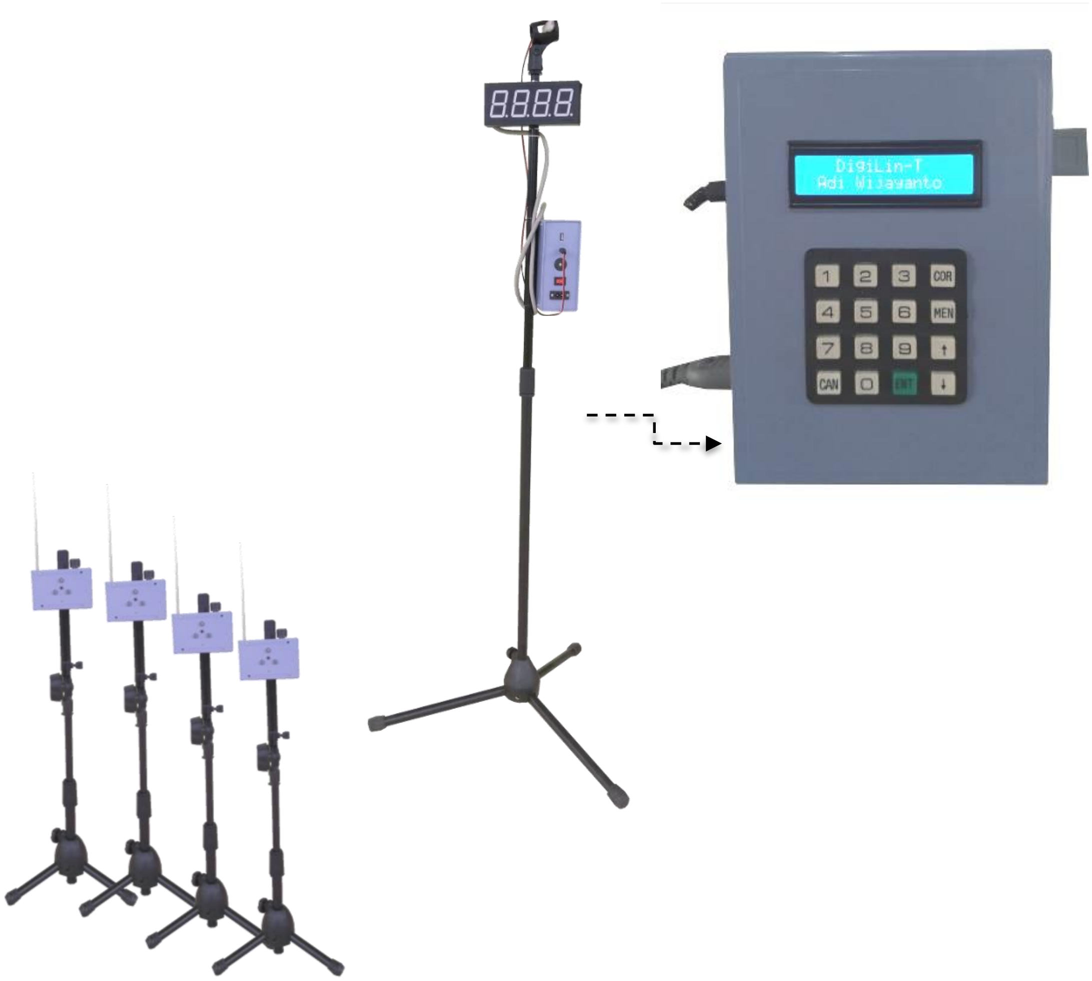

Figure 8. Digilin-T User Interface

Sports Science Experts provided several suggestions, including: 1) Wooden poles should be changed to metal poles which are portable and can be summarized, so that mobility is greatly facilitated; 2) Each side of the sensor box is numbered, making it easier to determine the post or layout location; 3) The seven segment component must be enlarged in size to provide clearer visibility for testers and testers; 4) there must be norms to differentiate results between men and women, this is because physiologically and anatomically the human body is different based on gender. Sports science experts as a whole expressed appreciation for the creation of digital sports tools, especially for agility. Apart from that, it was stated that the development of this tool needs to be followed up so that it can be implemented in very objective and real time agility tests and measurements. And the final conclusion from sports science experts is that this tool can be used with considerations for improvements based on the input above.

Validation from experts in the field of Information Technology and Electronics obtained several inputs and suggestions regarding the Digilin-T software and hardware products, including: 1) there must be a component used to regulate the sensitivity of the sending and receiving sensors; 2) a detection sensor indicator must be provided to detect the presence of obstacles; if there is an obstacle, it will respond by giving a signal, so that there is detection of sending and receiving signals that function on all sides; 3) The data cable and power cable need to be extended, so that the test is not disturbed, especially when starting and when finishing; 4) after the timer stops, the display at the conclusion of the results of the tests and agility measurements must be known as soon as possible, this means that the Digilin-T software and hardware have added value. 5); The tool support frame needs to be improved in terms of aesthetics and function, especially when it is frequently moved, so it must be removable or easy to carry anywhere.

Researchers have improved input on the weaknesses of the Digilin-T Hardware Software from the Validators, including 1) changing wooden poles into portable iron poles, namely using a tripod, so that they can be made more compact, by becoming portable poles, then easier to pack when finished using, which results in easy portability; 2) to make it easier to install and avoid mistakes that result in errors in the DigilinT system, each pole is given a code in the form of points in the order of one to six points; 3) for the level of readability of the results in seven segments, the size is enlarged to 10 centimeters for each digit, so that it can be clearly read at a distance of 30 meters; 4) the most serious improvement is the existence of norms that separate the results obtained by men from the results obtained by women, so that researchers have to go to the field to take raw data and convert it into separate value ranges for men and women, besides that there are also changes in programming language coding, where many logic flows and listings are added.

Improvements to Digilin-T software and hardware products resulting from Information and Communication Technology experts are: 1) adding a Potentio which is used to adjust the sensitivity of the sending sensor and receiving sensor, with this use it can be set between rooms with lots of sunlight or when there is little or even none. sunlight, when there is a lot of sun, the sensitivity must be increased so as not to be disturbed by the sun's heat waves, whereas when there is dim or even no sun, such as in a room that is only lit by lamps, the sensitivity must be lowered; 2) adding a detection sensor indicator LED which is used to detect obstacles. If there is an obstacle it will signal, so that the user will know which sensors are still functioning well and which ones are not functioning properly; 3) lengthen the data cable and power cable, so that the test is not disturbed, especially when starting and when finishing, and the placement of the master control pole must be next to the start or finish sensor; 4) The addition of a display to the conclusion of the results of tests and agility measurements must be known as soon as possible, so the improvement is to add an LED display that is integrated with seven segments; 5) The problem with the pole has been fixed in the same way as suggested by using a portable iron pole, namely using a tripod, so it can be neater and more concise, by making it a portable pole.

This small group experiment are PGMI students who were taking physical and health education courses at the Faculty of Tarbiyah and Teacher Training at Sayyid Ali Rahmatullah Islamic University Tulungagung (UIN SATU). From this trial there was input from students after they twice tried and practiced both designing and carrying out Agility Tests and Measurements using the Digilin-T Software and Hardware. The recommended inputs are: 1) Apart from the preparation code and start code in the form of a Flash of Light, it is necessary to add Sound so that the testee who will carry out the test is not disturbed in concentration because they have to see the flash as the start code for the agility run; 2) It is necessary to create Implementation Instructions for both the Digilin-T Software and Hardware Assembly to make it easier to assemble and operate the tool; 3) Every time you pass the sensor, try to make sure there is a sign, so that the tester knows whether the movement flow is wrong or not.

The improvement to the Digilin-T is to add a buzzer or sound that comes from a mini speaker placed on the master control, the code one sound "Tiit Tiit" along with the flash light flashing twice is preparation, then after 1 second there will be a buzzzer sound " Tiit" together with the flash flashes once which means starting to run agility along a predetermined route, this sound helps the person being tested to more easily prepare to do agility movements through hearing, because it could be that the child being tested is not facing the lights, so Voice assistance helps them a lot. Apart from that, the next improvement is to add detection for every sensor that is missed by a "Tiit" buzzer sounding once at the six sensor points, adding detection for each sensor automatically changes the programming logic flow and coding in the Digilin-T programming language. The final improvement is to add a Manual Book in printed and soft file (pdf) form as a guide for operating the tool as well as instructions for implementing the Agility Test using the Digilin-T tool.

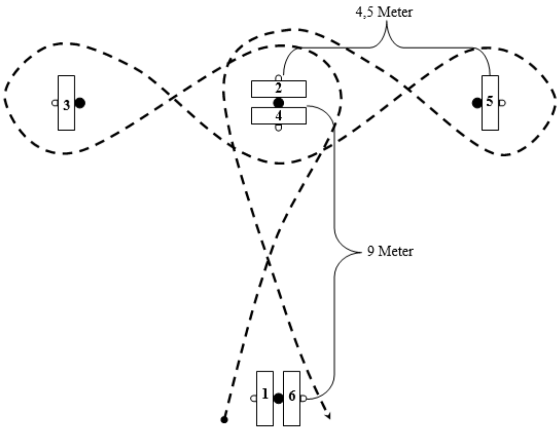

Figure 9. Digilin-T Test in Small Group

The small group trial was carried out at Sayyid Ali Rahmatullah State Islamic University on Madrasah Ibtidaiyah Teacher Education students totaling 12 male students and 28 female students, for a total of 40 students. The data obtained shows that in the male sample the fastest value was 9.43 seconds and the slowest was 12.84 seconds, while the average was 11.16 seconds, so it can be categorized as "Average/Good enough" in male norms. Meanwhile, data from the female sample obtained that the fastest value was 11.05 seconds and the slowest was 16.87 seconds, while the average was 13.67 seconds, so it could be categorized as "Average/Fairly Good" in the Female norm. The average results show that men are faster than women, but if they are categorized according to value norms, then both are at the same norm, namely "Average/Good enough". On average, the female group is slower than the male group, this is due to the physiology and anatomy of the male body being higher both in terms of quality and quantity of muscle fibers than females, so that males are stronger in producing muscle power and explosive power. Apart from that, it is also influenced by the hormone testosterone, where the amount of the hormone testosterone is large in men, the function of this hormone is as an anabolic which can increase muscle capacity.

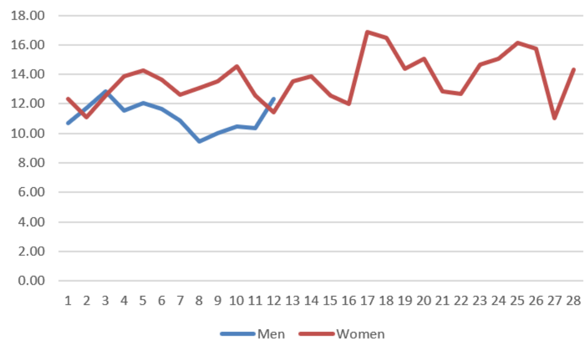

Figure 10. Agility Data in Small Group

The agility results in the small group experiment that males were more agile than females. In two rounds of the agility test, it was found that the average male was 11.34 seconds, while the average female was 14.07 seconds. These data indicate that men have better dynamic balance and leg muscle explosive power than women.

The results of the questionnaire on the use of DigilinT software and hardware show that in general, respondents are still unable to operate DigilinT correctly and many still experience confusion, caution and are still afraid of damage to the equipment. So it can be described that respondents are less user friendly towards DigilinT. This data explains in detail about the ease of assembling DigilinT, which is still at 47.50%, it can be done easily. Meanwhile, in operating the DigilinT power, more than half of the respondents said they could do it (55.00%) because it was very easy and almost the same as operating the power button on other electrical devices. The ease of setting agility norms on DigilinT is still very low, namely 30.00% due to the way the logic flows are not yet synchronized between the user and the user interface. The ease of reading sensor detection on DigilinT is very low at 40.00%, while the ability to carry out agility tests and measurements using DigilinT is 60.00%. In the reading component, the test results were only 52.50, and the reading ability criteria were 65.00%.

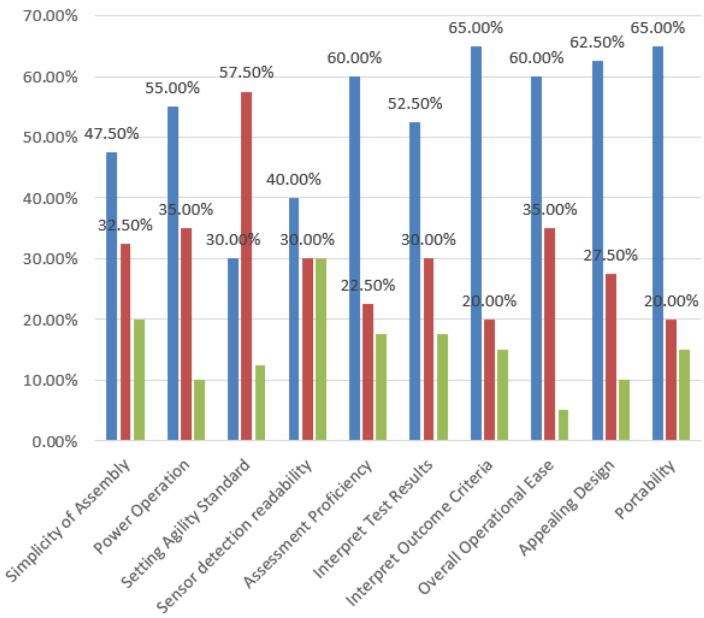

Figure 11. Results of Small Group Experiment Questionnaire

Large group experiment were carried out at Maulana Malik Ibrahim State Islamic University and IAIN Kediri. The research sample was PGMI Study Program students who were taking or had taken courses in physical education, sports and health. In this large group trial, we still received input from respondents, including that the appearance of the buzzer was very lacking in aesthetics, and it should be packaged neatly. The final revision of this DigilinT product is to insert the buzzer into the master box, so that it looks neater and becomes one unit in the box. Apart from that, when carrying the device there are not many components that are scattered or left behind, because everything has been included in the master control.

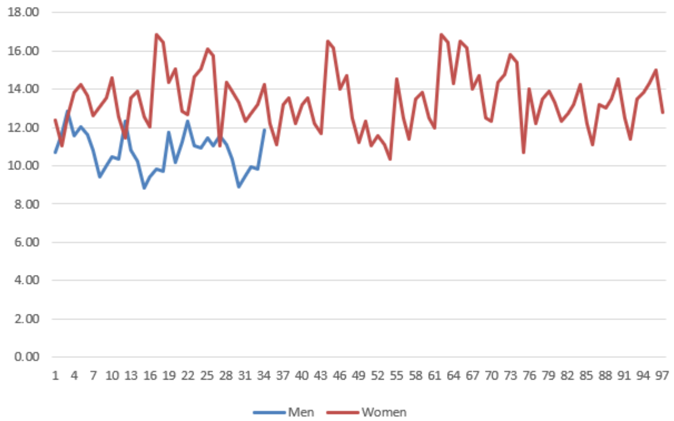

Figure 12. Agility Data in Large Group

This large group trial also tested testee agility with the DigilinT test at the two PTKIN campuses. The agility data shows overall that men are faster in agility compared to women. This shows consistently that anatomically there are more male muscle fibers in quantity with the development of muscle fibers, besides that physiologically it shows that male muscle fibers function more qualitatively, especially during muscle contractions on sliding filaments which produce a lot of energy from Adenosine (Tri Phosphate (ATP)).

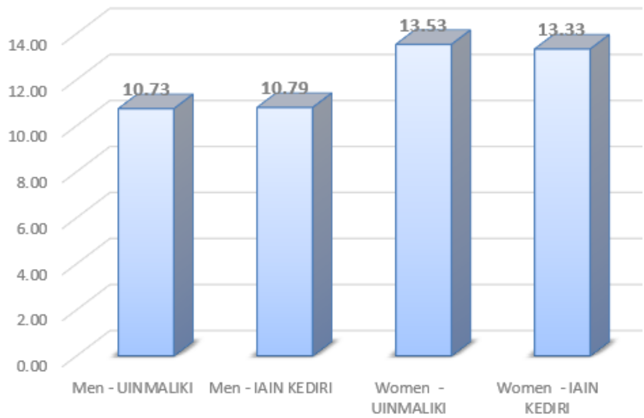

Figure 13. Agility Data in Large Group Trials at UINMALIKI and IAIN Kediri

The Data from separate large group trials between men and women in the two PTKINs shows that men are more agile than women, where in men at UINMALIKI their agility was 10.73 seconds when tested using DgilinT, not much different, the results are almost the same as men at IAIN Kediri is 10.79 seconds. Meanwhile, the average agility results obtained for women at UINMALIKI were 13.53 seconds and a difference of 0.20 seconds slower compared to women at IAIN Kediri, namely 13.33 seconds. These data show that place does not affect the level of agility, but what does is gender.

Figure 14. DigilinT Test in Large Group

The questionnaire data regarding the use of DigilinT Hardware Software in large group trials consisted of five question components and experienced component reduction, this was based on the fact that the components in the questionnaire during small group trials consisted of ten components and those who answered ease/mastery of the components by selecting "Yes" above 60% with 5 question components. The 5 components that are below 60% in the small group trial questionnaire will be asked again during the large group trial. The following is the data on the results of the five component questions.

The use of DigilinT software and hardware in large group trials has shown increasingly better capabilities. This can be seen in general that the level of ability in operating DigilinT is very high. The level of ease of assembling, for respondents, reached 77.10%, the component for turning on and operating DigilinT was 93.13, while the level of ease of setting agility norms in DigilinT hardware reached 73.28%. The level of ease in detecting sensors is 90.08%, and the level of ease of reading the criteria obtained from the test is 91.60%.

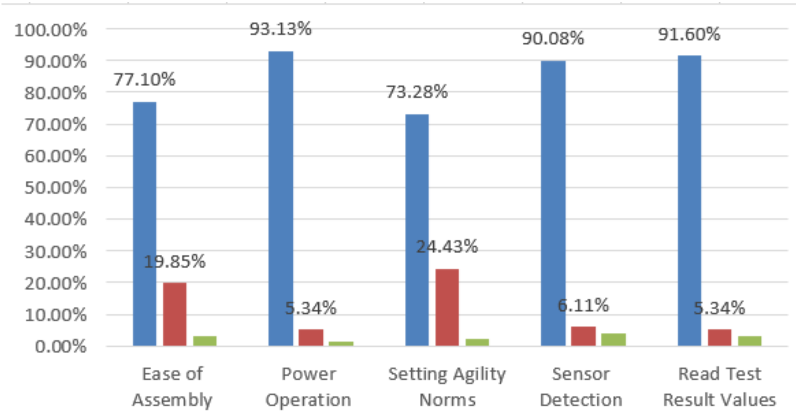

Figure 15. Large Group Trial Questionnaire Results

The overall increase in ability was due to the fact that before assembling and running the DigilinT software and hardware, all testees had read and paid close attention to the guidebook provided by the researchers, after which the testers explained in detail how to assemble, operate, carry out agility tests and even read the results of agility tests using DigilinT.

This research produces Digital Agility-T (Digilin-T) software and hardware based on Infrared Photodiode Sensor, but improvements are needed to improve the perfection of the program, so improvements are expected, especially in the database criteria which are not only gender but should also be adjusted based on age criteria. By adding several factors or variables, it is hoped that the program will be closer to perfection. Other research is needed to measure agility, not only in the agility of the lower limbs but also other agility such as the agility of the upper and lower legs, as well as the upper and lower arms. So that the agility results can represent all limbs in the body.

CONCLUSION

This Digital Agility-T (Digilin-T) hardware and software is useful as a tool for testing and measuring agility which is operated automatically using a photodiode sensor, the results of the data and measurements will be displayed in real time on seven segments and LCD displays simultaneously, so that all student entities, lecturers, testers and other stakeholders can find out directly at that time. Digilin-T Software and Hardware is a device that can replace the role of the testor in carrying out tests and measuring agility. If in general agility tests and measurements require more than two testors to handle one test person, then in carrying out tests and measurements using Digital Agility-T (Digilin-T) Hardware and Software only requires one testor so that the time used for the test This is more efficient and reduces errors and reduces subjectivity caused by the tester's lack of accuracy.

As many as 82.22% of respondents stated that it is very necessary to create automatic agility system software and hardware to support determining a person's level of agility. As many as 68.97% of respondents are very capable of using if there is agility software and hardware. This indicates that respondents really hope to use the device to help test and measure agility. The main product that will be produced in this research is digital agility-T (Digilin-T) software and hardware based on an infrared photodiode sensor. The next step taken is a deeper and more detailed analysis and design, including: (1) Context Diagram, (2) Data Flow Diagram (3) Flowchart and (4) PCB (Printed Circuit Board) on the computer, (5) Printed Circuit Physical board.

The results of agility carried out in small groups and large groups indicated that men were more agile than women. In the agility tests and measurements carried out, it was found that men were on average faster and more agile than women. These data indicate that men have better dynamic balance, speed, number of muscle fibers both in quality and quantity, and leg muscle explosive power than women.

The level of effectiveness of Digilin-T Hardware and Software can be seen that the ease of assembling, turning on and operating Digilin-T for respondents reached 77.10%, the components for turning on and operating DigilinT was 93.13, while the level of ease of setting agility norms in DigilinT hardware reached 73.28% . The level of ease in detecting sensors is 90.08%, and the level of ease of reading the criteria obtained from the test is 91.60%. In general, it can be explained that Digilin-T has a very high level of usability, operation, readability and mobility and can be used by all stake holders.

REFERENCES

Bassil, Youssef. 2012. A Simulation Model for the Waterfall Software Development Life Cycle. International Journal of Engineering and Technology (IJET). Volume 2 No. 5, May, 2012. ISSN: 2049-3444.

BRIN (Badan Riset dan Inovasi Nasional). 2024. Pembangunan SDM Faktor Penting dalam Mencapai Visi Indonesia Emas 2045. https://www.brin.go.id/news/-118590/pembangunan-sdm-faktor-penting-dalam-mencapai-visi-indonesia-emas-2045. (diakses 21 Mei 2024).

Farkh, Samer., Hamieh, Soumaya., Rousseau, Louis., Ismail, Bassel. 2021. Infrared Analyzes And New U/Th Dating Of Travertine (Erfoud’s Radier, Morocco): Consequences On Global Climatic Variations. International Journal Of Scientific & Technology Research. Volume 10, Issue 07, July 2021 Issn 2277-8616 81 IJSTR©2021 www.ijstr.org

Gumantan, Aditya dan Mahfud, Imam. 2020. Pengembangan Alat Tes Pengukuran Kelincahan Mengunakan Sensor Infrared. Jurnal Jendela Olahraga Volume. 05, No. 02, Bulan Juli, pp. 52-61 DOI: http://dx.doi.org/ 10.26877/jo.v5i2.6165 ISSN :

2527-9580 (print) ISSN : 2579-7662 (online).

Hery., Haryani, Calandra A., Mitra, Aditya R., and Widjaja, Andree E. 2022. The Design of Microcontroller Based Early Warning Fire Detection System for Home Monitoring. IJNMT (International Journal of New Media Technology), Vol. 9, No. 1 | June 2022

Khin, Aye Mar. 2019. Microcontroller Based Character Moving System. Journal of Innovative Science and Research Technology. Volume 4, Issue 2, February – 2019. International ISSN No:-2456-2165 IJISRT19FB203 www.ijisrt.com

Maryono, Setya Rahayu & Eunike Raffy Rustiana. 2017. Metode Latihan Kelincahan dan Fleksibilitas Pergelangan Kaki terhadap Keterampilan Menggiring Bola. Journal of Physical Education and Sports. Vol 6 (1) (2017). E-ISSN 2502-4477.

Miguel, José P., Mauricio, David and Rodríguez, Glen. 2014. A Review of Software Quality Models for the Evaluation of Software Products. International Journal of Software Engineering & Applications (IJSEA). Vol.5, No.6, November 2014. DOI : 10.5121/ijsea.2014.5603

Numata, Satoshi. 2018. Creating C# Programming Corpus using ANTLR4 for Non-Native English-Speaking Students. International Journal of Education and Research. Vol. 6 No. 11 November 2018.

Quang, Vo Ky., Zakaria, Nor Hidayati., Hieu, Bui Trong. 2016. Information Systems And Software Engineering. International Journal of Advanced Computational Engineering and Networking. Volume-4, Issue-4, Apr.-2016 ISSN: 2320-2106.

Raven, John., Qalawee, Mohamed., Atroshi, Hanar. 2016. Learning Computer Hardware by Doing: Are Tablets Better Than Desktops?. International Journal of Research in Education and Science. Volume 2, Issue 1, Winter 2016. ISSN: 2148-9955.

Siddhartha and Gajbhiye, VT. 2020. Method standardization of selected PAHs, PCBs and surfactants in sewage water. International Journal of Chemical Studies 2020; Vol 8 Num (2). P-ISSN: 2349–8528 E-ISSN: 2321–4902 www.chemijournal.com

Stathokostas, Liza., Little, Robert M. D., Vandervoort, A. and Donald, Paterson H. 2012. Flexibility Training and Functional Ability in Older Adults: A Systematic Review. Journal of Aging Research. Volume 10 No (1), 2012.

Winarno, Eko. 2005. Metode Penelitian dalam Pendidikan Jasmani. Malang: Lab Jurusan Ilmu Keolahragaan.

Wingate, Lory Mitchell. 2015. Project Managementfor Research andDevelopment: Guiding Innovation for Positive R&D Outcomes. London: CRC Press. ISBN-13: 978-1-4665-9630-6.

Young, Warren B., Dos'Santos, Thomas., Harper, Damian J., Ian, Jeffreys and Scott, W. Talpey. 2022. Agility in Invasion Sports: Position Stand of the IUSCA. International Journal of Strength and Conditioning. Vol 2 No 1 (2022).

Ramadhan, Al Akbar Rahmat., Iyakrus., Bayu, Wahyu Indra., Syafaruddin., Yusfi. Herri. 2022. Pengembangan Alat Ukur Tes Kelincahan Berbasis Teknologi Sensor Infrared. BRAVO'S Jurnal Pendidikan Jasmani dan Kesehatan. Volume 10 Nomor 4, Desember 2022, pp: 294-304.