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The effectiveness of a designed device for measuring and improving choice reaction time among players of physical education and sport Science College

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Abstract
The main purpose of the current study was to design a device for measuring and improving choice reaction time. The device is made up of mechanical materials such as a plastic box, buttons, signal lights) as well as electronic materials, and by relying on an electronic engineering (Arduino) program. The program is linking electronic circuits to mechanical materials. The device is a smart circuit and system that contain a battery of energy storage as well as a place to store information and transfer it on a SD card which the information can be transferred to the computer to the Excel program. The researcher used the experimental method for its suitability with the nature of the study. (24) Undergraduate Male students were chose from the second year of college of physical education and sports science, students at Salahaddin University –Erbil. (n=24, age 19 ± 1.45). The researcher chose the sample from the players of the college of physical education and sport science that practicing the following games (football, volleyball, and basketball), divided into two groups (experimental and control group) each group consisted of 12 students. After six weeks of practice on the CRT, the results showed the effectiveness of the designed device in the posttest for the advantage of the experimental group.

Keywords: Choice reaction time, motor learning

1. Introduction
In many sports, to enhance and improve athletes' skills, numerous types of technological aids or devices are being used. Reaction time is one of the important skills that have to be mastered in various sports games; it is the skill that helps the player to decide the type of response to the situation that stimulates them. With increasing competition levels and records in sport, the demand for new technology has increased as well. According to (Welford, 1980) [7]. There are three types of Reaction, 1. Simple reaction time: which gathers one stimulus and one responded. The second type of it called, Recognition reaction time; this type is more selective action toward different stimulation, in other words, there are some stimuli that should be responded to and other that should not get a response. And the third type of reaction time is, Choice reaction time, this type is more complicated than others, here there are multiple stimulus and multiple responses. The influence of complexity on RT has stimulated a great deal of interest in the field of motor control. The question of what aspect of response complexity is responsible for these increases in programming time has been a matter of much debate. As such researchers have investigated questions such as 'does the response complexity have the same effect on RT when the person knows in advance what movement will be made (simple reaction time) compared to situations where the movement response is not known until stimulus presentation (Choice reaction time). In simple RT tasks, participants know which response to produce prior to the presentation of the stimulus. In contrast, participants performing a choice RT task do not know the required response until stimulus presentation. With these differences, it is reasonable to suggest that some programming may be completed before the go signal or stimulus in a simple RT condition. Whereas in Choice RT preprogramming cannot be performed since the response selection must occur during the RT interval. On this basis, one might not expect simple RT to increase as a function of response complexity since programming can be performed prior to the RT interval (Sarteep, 2013) [5].

Reaction was considered as a mental ability, and the reason for that lies in its complex nature from the physiological aspect; where speed of a nerve impulse is demonstrated along with intensive physical work perception and decision-making (Hornikova, 2019) [2].

Researchers have shown that, with practice this ability can be improved to a certain point if the program enclosed muscular coordination and speed of movement. And as a result it is possible to. Increase it by 10 to 25 % (Choutka, 1987, Fong *et al*, 2013) [1, 6]. In sports and games, the signal that stimulus player and participant to react are lies in their opponent's movement, motion of the ball, the sound of the rings. Etc. Reaction time has a crucial role in making the right decision in the right time.

The challenge of getting new technology is mostly related to the high pricing of them. Devices and aids for measuring this skill are expensive. The importance of the current study embodies in making one of them with minimum expenses and the same indication results to devices that made to measure this mental ability. The researcher made a designed device that records the choice reaction time as well as improving it.

1.2 The aims of the study

1. Design a device that measures choice reaction time using Ardinuo.
2. 2-Using the designed device to improve choice reaction time among physical education and sport science college's players.

1.3 The hypotheses of the study

1-The designed device has a positive effect on measuring and improving choice reaction time.

2-There is a significant difference between the experimental and control group and for the advantage of the experimental group.

1.4 Research scopes

1. Human scope: (24) Undergraduate Male students, chosen from the second year of college of physical education and sports science, students at Salahaddin University –Erbil
2. Time scope: 22/1/2020 until 4/3/2020.
3. Spatial scope: the lectures halls at college of physical education and sport science.

2 The research field and procedures

2.1 Research method

The researcher has used the experimental method for its suitability with the nature of the study.

2.2 Research community and its sample

The research sample was chosen deliberately to include (24) Undergraduate Male students, represented 90% of the entire research community; chosen from the second year of college of physical education and sports science, students at Salahddin University –Erbil. (n=24, age 19 ± 1.45). The sample has been chosen from the players of the college of physical education and sport science that practicing the following games (football, volleyball, and basketball male), then the sample divided into two groups (experimental and control group) each group consisted of 12 students.

2.3 Tools and equipment of the study

2.3.1 Tools

1. Personal interviews.
2. E and hard Sources.

2.3.2 Equipment

1. The designed device of measuring choice reaction time.
2. Sony laptop.

2.4 Components of the designed device

2.4.1 what is the device?

The device is made up of mechanical materials (such as a plastic box, buttons, signal lights) as well as electronic materials, and by relying on electronic engineering and the Arduino program, the program specializes in linking electronic circuits to mechanical materials. The device has a smart circuit and system that contained a battery for energy storage as well as a place to store information and transfer it on a smart card which the information can be transferred to the computer according to the Excel program.

2.4.2 the main function of the device

The device measures the choice reaction time and has a cycle for practicing that as well which contained 70 trails of each block.

2.4.3 Description of the device

2.4.3.1 dimensions of the device

A Box with dimensions of 28 cm length, 15 cm height, and seven buttons lit each light against one button. The device has programmed on 70 repetitions for one block as one cycle. And the signal is given randomly between trails in no sequential order neither in terms of pressing nor of time duration. After completing the attempts 70 the device stores data on a SD Card.

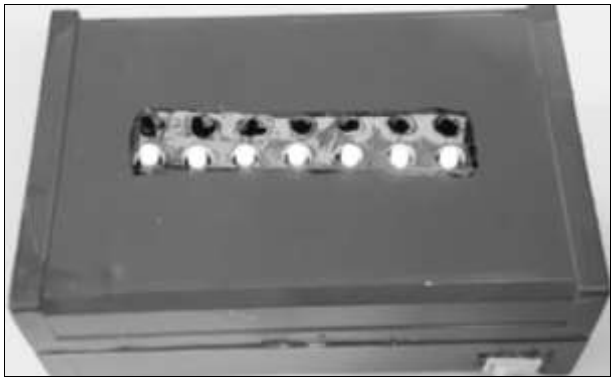

Fig 1: the designed device of the current study

2.4.3.2 How does the device work?

The device does not need an electrical conductor as it contains a rechargeable battery. After switching on the device, the program gives a prompt to prepare and be lit by the light in all buttons for three times. The test begins to neutralize the light for each button and gradually at a speed of 800 milliseconds to 300 milliseconds and randomly. It records each of the 70 attempts.

2.5 scientific factors of the designed device.

2.5.1 validity

Validity refers to how accurately a method measures what it is intended to measure. And to approach this factor, the device has presented to experts in motor learning and electronic engineer.

2.5.2 Reliability

Reliability is about the consistency of a measure. To substantiate the reliability of the device, the researcher used the (re-apply) method on a sample not from the study sample.

Correlation coefficient was used, after applying the statistical process, the result showed a value of (0.95). This indicates a high stability of the device to measure the speed of the complex reaction times.

2.6 pilot study

The pilot study is a preliminary experience that the researcher performs on a group of players or individuals other than the research sample. The benefit of the exploratory experience is:

1. Exploring all the circumstances surrounding the research challenges that could face the researcher during the study.
2. It contributes to identifying deficiencies in the curriculum application procedures and data collection tools related to the research, so that its instructions can be modified in light of the results of the exploratory study carried out by the researcher.

The exploratory experiment was conducted on a sample of students from the Faculty of Physical Education and Sports Science at Salahaddin University – Erbil on 27/12/2019.

2.7 main experiment

The practical program has been applied to the main sample for research on the second-year students, (24) Undergraduate Male students, chosen from the second year of college of physical education and sports science, students at Salahaddin University –Erbil. The sample divided into two groups. The experimental group and the control group, the experimental group had practice with three blocks, each session 10 minutes per person for four times a week and for six weeks.

2.8 Method of data collection

After the completion of the main experiment, the data previously stored on the device's memory was unloaded and transferred to the computer. The data was placed for applying statistical methods to it.

2.9 Statistical means

For the statistical process, the researcher used (SPSS) software and the tests that conducted were: (the mean, simple correlation coefficient, standard deviation, T-test for depended and independent sample).

3. Presentation, analysis and discussion of the results

This part includes, presenting the results and analyzing them based on the data obtained by the researchers in measuring choice reaction for individuals of the research sample. Since the collection and presentation of data without discussion and interpretation will not concrete the solution for the study arguments.

3.1 Results

In order to know the effect of the proposed device in developing choice reaction among the study sample; choice reaction time was measured for the research sample (both groups). Pre and posttest were conducted, and blow the data's that extracted from the device and recorded.

Table 1: Shows the mean, standard deviation, and t-test of the research sample in the pre-test

Group	The Mean	Standard deviation	T-Test	P-value	results
Control	414.4	47.24	1.27	2.07	not significant
Experimental	430.6	41.32			

The (T) level of signification (0.05) and df (24-2) = 2.07

From Table (1) we note the mean of the results of the pre-test for the control group members reached (414.4) milliseconds with a standard deviation (47.24), while in the same table, the mean of the results of the pre-test for the experimental group members was (430.6) milliseconds with a standard deviation (41.32) As in the same table, we note (T) value for the pre-test was (1.27). In comparison to P- value, it becomes clear that it is less and this means that there are no significant differences in the pre-test and for both groups. Therefore, the two groups are considered alike.

Table 2: Shows the means, the standard deviation, and the t-test of the research sample in the posttest

Group	The Mean	Standard deviation	T-Test	P-value	results
Control	455.3	94.5	2.10	2.07	significant
Experimental	313.4	64.4			

The (T) level of signification (0.05) and df (24-2) = 2.07

Table (2) shows the mean the post test for the control group members who reached (455.3) milliseconds with a standard deviation (94.5), while in the same table, we note the mean of the post test for the experimental group members reached (313.4) degrees and with a standard deviation (64.4). As in the same table, the (T value) shows 2.10, and when compared to the P- value, it becomes clear that significant degree has accomplished in the post test and for the two groups and in favor of the experimental group that used the proposed device

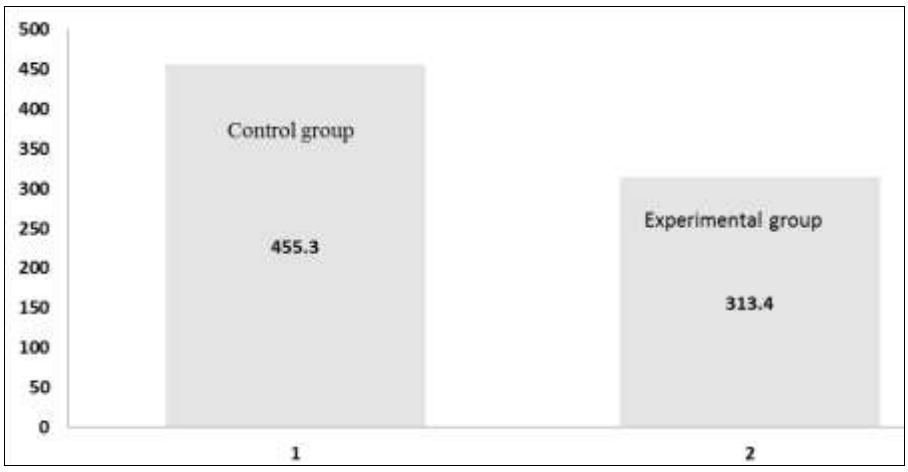

Fig 2: Shows mean of the control and experimental groups in the posttest

Table 3: Shows the means, the standard deviation, and the test of the experimental group members in the pre and post test

experimental group	The Mean	Standard deviation	T –Test	P- value	results
pre-test	439.1	41.3	3.92	2.20	significant
post-test	313.4	64.4			

The (T) level of signification (0.05) and df (12-1) = 2.20

From Table (3) we note the mean of the results of the pre-test for the experimental group members were reached (439.6) milliseconds with a standard deviation (41.32), while in the same table, we note the mean of the results for posttest for the experimental group members reached (313.4) degrees and a standard deviation (64.41). In the same table, we note that, the value of (T) for the post-test was 3.92, and when compared to the P- value it becomes clear that it is greater, and this means that, there are significant differences in the two tests and in favor of the post test, which used the proposed device.

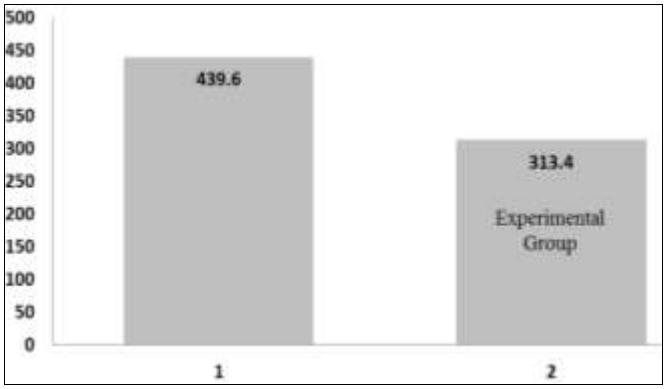

Fig 3: Shows the mean of the experimental groups in the posttest

3.2 Discussion

As detailed in Table (2), it becomes clear to us that there are significant differences in (T) test (independent groups), and the advantage were for the experimental group which used the designed device proposed by the researcher. Throughout using of the device and practicing it during the experiment period. Meaning their reaction time reduced and improved. And this is consistent with other previous studies in reaction time. The differences can be observed from Also during Figure (2), where the experimental group achieved shorter response time than the control group, and in this type of time-related research variables, the least recorded time, the better.

For the purpose of determining the development of the experimental group, the researcher conducted a comparison of the results of the experimental group for the pre- and post-test. Furthmore, the same table showed (the mean of the results of the post-test for the experimental group was (313.4) milliseconds and the standard deviation (64.41). Furthermore, in the same table, we note the value of (t) for the post test of 3.92 and when compared to p- value it suggesting greater and this means, that there are significant differences in the both tests in favor of Post-test, which used the proposed device. This is a clear indication of the effectiveness of the device and its positive effect in developing the speed of complex reaction. And as Hansen & Elliot, 2009,28 stated that, programmed training using modern devices can make sure of developing speed of all kinds, including the speed of complex reaction (Okubo *et al*. 2016) [4] Stated that with a training program will reduce the reaction time, and in their study showed that both reactive and volitional stepping intercessions reduce falls among older adults by approximately 50%. This is a significant improvement among older people.

Based on evidence of past research and the results of the current study, we can say that the research hypotheses have been achieved by presenting and analyzing the data and coming out with a positive result.

4.1 Conclusions

1. The presence of statistically significant differences between the experimental and control groups in the post-test in favor of the experimental group.
2. The presence of statistically significant differences between the pre and posttests of the experimental group and in favor of the post test.

4.2 Recommendations

1. Emphasis on the use of the proposed device to develop the speed of the complex reaction.
2. Applying the device to various other samples to know the duration of the accuracy of the reaction velocity measurement.
3. Conducting a study that deals with other determinants that the study did not discuss with research.

1. The results of the results of the current study should not be generalized without further study.

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