

# Technological Innovation with Visual and Auditory Stimulus Testing the Validity and Reliability

*by* Endang Rini Sukamti

---

**Submission date:** 27-Jun-2020 07:59PM (UTC+0700)

**Submission ID:** 1350413216

**File name:** imulus\_Testing\_the\_Validity\_and\_Reliability\_of\_Smart\_WBRT\_51.pdf (298.89K)

**Word count:** 3801

**Character count:** 20717

# Technological Innovation with Visual and Auditory Stimulus: Testing the Validity and Reliability of Smart WBRT 515-GM

Endang Rini Sukanti<sup>1,\*</sup>, Gunathevan Elumalai<sup>2</sup>, Siswantoyo<sup>3</sup>, Junadil Saputra<sup>4</sup>, Mansur<sup>5</sup>,  
Herlambang Sigit Pramono<sup>6</sup>, Wisnu Nugroho<sup>7</sup>, Agung Nugroho<sup>8</sup>  
<sup>1,3,5,6,7,8</sup>Universitas Negeri Yogyakarta, Sleman, 55281 Daerah Istimewa Yogyakarta, Indonesia  
<sup>2</sup>Universiti Pendidikan Sultan Idris, Tanjong Malim, 35900 Perak Darul Ridzuan, Malaysia  
<sup>4</sup>Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia

**Abstract:** Reaction time (RT) is one of the fitness components based on motor skills and vital to health-related skill. It's important to sprinting events which requires fast starting to win a race. The SMART Whole-Body Reaction Time 515-GM instrument is a new tool to measure whole-body reaction time. Normally reaction time tested individually but this instrument able to measure five subjects one-shot. This cross-sectional study is involved as much as 80 respondents, which consists of 40 males and 40 females and collected randomly. The SMART Whole-Body Reaction Time 515-GM is correlated with Nelson Choice Reaction Time to examine its validity. The retest procedure is applied to find the reliability of the new instrument. By applying the Pearson product Moment correlation test, this study found that the result of validity and reliability are more than 0.80. It indicates that a new SMART Whole-Body Reaction Time 515-GM instrument fulfils the requirement of a testing protocol. Also, it has high validity and reliability and acceptable. In conclusion, the instrument can reduce cost, time and can use to test many subjects efficiently and effectively.

**Keywords:** Validity, reliability, Whole Body Reaction Time, 515-GM Instrument, visual, an auditory stimulus

## Introduction

Reaction time (RT) is one of the fitness components because of motor skills and vital to health-related skill too. The reaction time can enhance the performance in sports. React faster on the situation in our daily life is very important to be safe and smart. For instance, when applying sudden brake while driving, react when touched hot items, move away immediately to the right direction in dangerous situations and so on. In sports reaction time is one of the essential skills required to perform excellently. It reflects the minimal time needed to respond to a stimulus during the game played [1]-[2].

The excellent performance in games requires not only physical movement capabilities but also needs sensory, cognitive skills [3]. Most of the sports performed under pressure because of the physical, psychological, environmental demands [4]. Expectations and pressure to perform to a high standard require the athlete's ability to quickly and accurately pick up relevant stimulus. It will reduce the time of making a decision and will allow more time for preparation of motor movement [5]. Perceptual abilities and reacting faster is an advantage to the player's to perform successfully [6]-[7]. Reaction time is a key to strategy in most of the sports which require fast and immediate reaction such as martial arts, team ball games and sprinting events in athletics.

In open skill-dominated sports, such as team ball sports like volleyball, handball, netball and football are considered more environmentally open than individual open skill-dominated sports like tennis and badminton. The sprinting events in athletics considered closed skill-dominated sports which athlete's skills are not much affected by the environment. Visual and auditory reaction time influences the high performance of game players. There are games needs reaction based on visual stimulation, auditory stimulation, or both stimulations to react faster and successfully to score or win the race.

Reaction time is vital in most games to require dynamic and immediate action from the players, especially in catching, hitting and passing to the right target. It's also crucial in spring events which require fast starting to win a race [8]. Based on previous studies, the players' performance and achievements are proved that the reaction time is a necessary motor skill. Itacquired by every sports player [9]-[10]. Testing players' reaction time usually conducted base on requirement and needs. Most of the player has tested individually. It will take more time to test a large number of people. It will reduce the interest to check reaction time among sports players. Considering this situation, we designed a Whole-Body reaction time instrument where we can test 5 subjects in one time and the reaction time tested by sound (auditory) and light (visual). The testing procedure between five people also can give some motivation to the subjects to do their best. A new instrument needs to be validated and tested reliability before introduced to the testing field. Based on the testing protocol and guidance, this study is conducted to determine the construct validity and reliability for this Whole-Body reaction time instrument.

## **Methodology**

SMART Whole-Body Reaction Time 515-GM instrument is a new device for physical motor ability assessment. This digital instrument builds to measure players' ability to react and move accurately as fast as they can by choice of the stimulus and this cross-sectional study conducted among 80 undergraduate students from faculty of Sports Science, Universiti Pendidikan Sultan Idris. There are 40 males and 40 females aged 20 to 25 years (mean age 22.85±) were randomly selected to test their total body reaction time. We use the Nelson choice reaction time score and SMART Whole-Body Reaction Time 515-GM score to examine the value of validity of the instrument. The reliability of this instrument tested by retest method. There are two different tests conducted to check the reliability, which is sound (auditory) and light (visual). The data were analyzed using Pearson Product Moment by assisting the statistical analysis software, i.e. SPSS-23.

## **Results and Discussion**

For measuring the speed of execution of a movement, the SMART Whole-Body Reaction Time 515-GM Instrument is applied. The result of the analysis, as seen in Figure 1.



**Figure 1.** SMART Whole-Body Reaction Time 515-GM

Figure 1 shows the SMART Whole-Body Reaction Time 515-GM. Its constituted by accessories which make it possible to properly route the transit of information from the feet of the performer or the practitioner. It represented by (i) transmitter of light and sound for the signal of the practitioner. (ii) A mat on which athlete positions himself to perform a test. (iii) The electric cables which connect the carpet starter to the sensor memory. (iv) A graduated numeric screen for the resort of 5 results at the sametime.

### **Whole-BodyReaction Time 515-GM Instrument Mechanism**

The athletes or the test performers are positioned on an electronic carpet starter, the two feet parallel to the shoulder' width, the bent trunk; arms are flexed at hip height ready to speed up movement. The knees are bent about 110-140 degree. The performer's regerd is directed towards the transmitter of sound or light. When the signal is given, the time count begins and stops when the individual has left his feet from carpet. The result is automatically saved on the screen.

Figure 2 displays the execution of the reaction test with SMART Whole-Body Reaction Time 515-GM. In the image number (1), it showed the preparatory stage of the teacher where he must check in the reliability of the instrument with all the accessories. The device is formatted before the test. The second (2) image showed the position of the practitioners on the rubber plate, for the number 3, the practitioners must be very attentive to the signal and the reaction. Athletes are notified whether the signal is a sound (auditory) or a light (visual). As for the light, it can be configured according to the referendum of the eye of each multicoloured gift. The number (4) showed the final execution. For this test, it requires three times tests, and we recruit the best test. The last figure (5) showed the recording of the numerical values of thetest.



**Figure 2.** Execution of the Reaction Test with SMART Whole-Body Reaction Time 515-GM

The new instrument should have high construct validity to use as a tool for measuring Whole-Body reaction time accurately. The researchers conducted Nelson's choice reaction time test and SMART Whole-Body Reaction Time 515-GM test with the combination of sound (auditory) and light (visual) based on the procedures to examine the validity of instruments. The Pearson Product Moment analysis for validity showed correlation value  $r = 0.84$ ,  $p = 0.000$ . The finding indicates that the validity value is high based on [11]-[12], where the value more than 0.80 is high and acceptable (See Table 1).

**Table 1.** The result of the correlation between Nelson Choice and SMART Whole-Body Reaction Time 515-GM

	Nelson Test	Whole-Body Reaction Time
21 Correlation coefficient	1.000	0.842
Sig. (2-tailed)		0.000
Mean	0.195	0.194
Std. Deviation	0.058	0.053

Correlation is significant at the 0.01 level (2-tailed)

Reliability means the data collected using this new instrument trustworthy and consistent where ever it used. Table 1 above captures the result of the correlation between Nelson Choice and SMART Whole-Body Reaction Time 515-GM. The test will be reliable and give the same repeated results under the same conditions. The retest score for sound (auditory) test showed that the value of  $r = 0.87$  and  $p = 0.000$ . It means that the SMART Whole-Body Reaction Time 515-GM instrument is reliable and can be used to measure Whole-Body reaction time using sound among sports players, athletes and even normal individuals.

**Table 2.** The result of the correlation test and retest procedure with SMART Whole-Body Reaction Time 515-GM

	Test 1	Test 2
14 Correlation coefficient	1.000	0.873
Sig. (2-tailed)		0.000
Mean	0.197	0.192
Std. Deviation	0.057	0.054

Correlation is significant at the 0.01 level (2-tailed)

Table 2 showed that the result of the correlation test and retest procedure with SMART Whole-Body Reaction Time 515-GM. The reliability of SMART Whole-Body Reaction Time 515-GM instrument also tested using light with three colours. The test retest score for light (Visual) tests showed that the value of  $r = 0.89$ ,  $p = 0.000$ . It means the instrument is reliable and can be used to measure Whole-Body reaction time using light.

**Table 3.** The result of the correlation test and retest procedure using light SMART Whole-Body Reaction Time 515-GM

	Test 1	Test 2
Correlation coefficient	1.000	0.895
Sig. (2-tailed)		0.000
Mean	0.214	0.211
Std. Deviation	0.055	0.054

Correlation is significant at the 0.01 level (2-tailed)

The SMART Whole-Body Reaction Time 515-GM is a new instrument designed by the researchers for sports players, athletes, and any individual to evaluate their ability to react as fast as they can in games or daily life. This instrument able to evaluate the motor ability of players in games to make a faster and right movement or action to score. Balakrishnan et al. (2014) stated that reaction time is one of the crucial methods to learn about a person's central information processing velocity and coordinated peripheral movement response [13]. Also, they added that the visual desire response time is a kind of response time and is very important for drivers, pilots, safety guards, and so forth.

In this research, the decision should be made accurately within seconds to achieve their goal as a normal person reaction time is also important in our daily life, especially in dangerous situations. The fastest and right reaction can save our life and loved once. While driving the action to brake suddenly is one of the examples that need fast reaction time. Natsuhara et al. (2020), a faster reaction time indicates the efficiency of subjects' concentration and alertness, muscular coordination and performance at speed [3]. Therefore, a faster whole-body reaction time would benefit sports players and athletes by enabling them to react quickly to the demands of their sports. This statement proves how important the reaction time in our life as an athlete or an ordinary person. Saito & Hosokawa (1991) said that reaction times are still hardly ever mentioned in developmental psychology though they are an indicator of the neural maturity of children's statistics processing system [14]. Competence and potential are confounded in development. The place youth may additionally be in a position to reason, or keep in mind. Reicker et al (2007) said that the potential of a newly developed measure of records processing to discover deficits in cognitive functioning associated with more than one benefit from the human body [15]. Reaction time is the time interval between the onset of the stimulus to the appearance of appropriate voluntary response by the subject. Reaction time (RT) tests are regarded as easy and touchy checks for detecting variation in cognitive efficiency. RT checks measure the elapsed time between a stimulus and the individual's response to it. A downside of existing RT checks is that they require the full attention of a take a look at a character which prohibits the dimension of cognitive efficiency at some stage in everyday events tasks [16]-[17].

When the response was less vigorous, it took longer to move far enough to release [18]. The ruler of the test is to be used as part of a multifaceted concussion- assessment battery or as a way to track [19]. The study has done by [20], they attempted to assess the simple-reaction, attention and cognitive-reaction times to visible stimuli amongst scholar-athletes such as boxing, gymnastics, taekwondo, judo, karate and wrestling. The use of laptop video games, which mean that it was not very accurate; the reason why a new model of Whole-Body reaction time was very needed. Brenner & Smeets, (2019) reaction times can be used to judge how long it takes to process various things about external signals [18].

Excellence in activity overall performance requires not only physical and motor capabilities but also sensory, cognitive skills, in sports, reaction time and anticipatory talent are essential factors of perceptual skills [21]. Some research done showed that sprint race is to cowl the opposition dash distance in the shortest viable time. Each dash race commences at the second of begin sign announcement, which means, with the speed of a push off from the start blocks. The centre of attention of this lookup used to be on reaction time, which is the first thing in the time sequence of the sprint race [22].

A study done about important of reaction time in soccer was to decide the changes in easy response time and to outline correlations between simple reaction time and technical and tactical moves carried out via elite Greco-Roman wrestlers throughout a match. The strongest correlations had been located between each response time and movement time and the range of technical and tactical movements carried out at some point of the closing round. The quick response was a large element in deciding the satisfactory outcome, which is printed at a submaximal intensity of the effort at some stage in a match [23].

The goal of the study done in the training field found out the relationship between 60m sprint outcomes and reaction instances in athletes who took part in the World Indoor Athletics Championships. The response instances and 60m dash effects have been compiled for 483 sprinters (253 males, 230 female) who carried out a 60m dash event. As a result, it can be concluded that reaction time has outstanding significance on 60 m performance. The excellent reaction time is related to the higher overall performance of 60m dash in both male and girl athletes. Moreover, this is also similar for spherical 1, semifinal and final categories. Coaches and athletes may additionally reflect on consideration on improving response time to obtain higher 60m overall performance [24].

Reaction time and agility test have observed to be touchy in distinguishing corporations of athletes of one of a kind activity specialization: table tennis players, badminton players, fencers, taekwondo competitors and karate competitors. The good agility instances are very requested in athletes of racquet sports, accompanied employing competitors of combat sports with reactions to visible stimuli, then gamers of ball sports, and in the end opponents of combat sports activities with reactions to tactile stimuli. Reaction time and agility are both needs of many sports in the worldwide [25].

From the research above, there are few manual and online reaction time instruments to test simple reaction time and choice reaction time individually. The individual testing procedure needs more time and passion from the participants. Based on all these, the researchers designed this instrument to evaluate five (5) subjects together easily. The instrument validated using construct validity procedure by correlating the scores between Nelson Choice Reaction Time test and SMART Whole-Body Reaction Time 515-GM test. The result proved that the new instrument has high validity and reliability. The findings confirmed that it could be used to evaluate Whole-Body reaction time accurately.

## Conclusion

In conclusion, the Whole-Body reaction test is susceptible to practice effects; therefore, practitioners using this test for diagnostic or to evaluate the reaction time, which is more useful in the whole sports branches. Also, the Whole-Body reaction test was found affordable and easy to be done. The reaction time is testing widely in computerized cognitive assessments and biometrics skills. The reaction time test is administered by presenting a subject with a visual and auditory stimulus on a computer monitor and prompting the individual to respond as quickly as possible. The individual's reaction time is calculated as the interval between presentation of the stimulus and the time recorded from the mechanical response. Whole-Body reaction test was straightforward to assess the athlete's capacity about the reaction time quickly.

## Acknowledgements

We would like to thank for all the participants in this study and Universiti Pendidikan Sultan Idris. We also would like to thanks for Unversiti Malaysia Terengganu that has supported this research publication.

## References

- [1] Savelsbergh, G. J., Van der Kamp, J., Williams, A. M., and Ward, P. Anticipation and visual search behaviour in expert soccer goalkeepers. *Ergonomics*, vol. 48, no. 11-14, 2005, 1686-1697.
- [2] Iswana, B., and Siswantoyo, S. Model latihan keterampilan gerak pencaik silat anak usia 9-12 tahun. *Jurnal Keolahragaan*, vol. 1, no. 1, 2013, 26-36.
- [3] Natsuhara, T., Kato, T., Nakayama, M., Yoshida, T., Sasaki, R., Matsutake, T., and Asai, T. Decision-Making While Passing and Visual Search Strategy During Ball Receiving in Team Sport Play. *Perceptual and Motor Skills*, vol. 127, no. 2, 2020, 468-489.
- [4] Service A. N. P., and Wildlife. Special issue. Special issue. *Australian Ranger Bulletin*, vol. 4, no. 1, 1986, 9-10.
- [5] Savelsbergh, G. J., Williams, A. M., Kamp, J. V. D., and Ward, P. Visual search, anticipation and expertise in soccer goalkeepers. *Journal of sports sciences*, vol. 20, no. 3, 2002, 279-287.
- [6] Syauro, R. A. Perbandingan Whole Body Reaction Time dan Anticipation Reaction Time Antara Atlet Kata dan Kumite Cabang Olahraga Karate. *Jurnal Terapan Ilmu Keolahragaan*, vol. 1, no. 2, 2016, 30-36.
- [7] Putra, A. P. and Siswantoyo, M. The Development of Smart Flexibility Tools to Measure the Digital-Based Abilities. In *2nd Yogyakarta International Seminar on Health, Physical Education, and Sport Science (YISHPESS 2018) and 1st Conference on Interdisciplinary Approach in Sports (CoIS 2018)*. Atlantis Press.
- [8] Nuri, L., Shadmehr, A., Ghotbi, N., and Attarbashi Moghadam, B. Reaction time and anticipatory skill of athletes in open and closed skill-dominated sport. *European journal of sport science*, vol. 13, no. 5, 2013, 431-436.
- [9] Memmert, D., Noël, B., Machlitt, D., van der Kamp, J., and Weigelt, M. The role of different directions of attention on the extent of implicit perception in soccer penalty kicking. *Human Movement Science*, vol. 70, 2020, 102586.

- [10] Shaari, J. S., Hooi, L. B., and Siswantoyo, S. The Effectiveness Of Psychological Skills Training Program On Netball Shooting Performance. *Cakrawala Pendidikan*, vol. 38, no. 1, 2019, 174-187.
- [11] Miller, C. C., and Cardinal, L. B. Strategic planning and firm performance: A synthesis of more than two decades of research. *Academy of management journal*, vol. 37, no. 6, 1994, 1649-1665.
- [12] Safrit, M. J., and Wood, T. M. *Introduction to Measurement in Physical Education and Exercise Science*. Mosby: St. Louis, Missouri, 1995.
- [13] Balakrishnan, G., Uppinakudru, G., Girwar Singh, G., Bangera, S., Dutt Raghavendra, A., and Thangavel, D. (2014). A comparative study on visual choice reaction time for different colors in females. *Neurology research international*, 2014, 301473.
- [14] Saito, K., and Hosokawa, T. Basic study of the VRT (visual reaction test): the effects of illumination and luminance. *International Journal of Human-Computer Interaction*, vol. 3, no. 3, 1991, 311-316.
- [15] Reicker, L. I., Tombaugh, T. N., Walker, L., and Freedman, M. S. Reaction time: An alternative method for assessing the effects of multiple sclerosis on information processing speed. *Archives of clinical neuropsychology*, vol. 22, no. 5, 2007, 655-664.
- [16] B. Cinaz, C. Vogt, B. Arnrich and G. Tröster. A wearable user interface for measuring reaction time. In *International Joint Conference on Ambient Intelligence* (pp. 41-50). Springer, Berlin, Heidelberg.
- [17] Juniarta, T., and Siswantoyo, S. Pengembangan Model Permainan Rintangan (Handicap Games) Untuk Latihan Kebugaran Jasmani Anak Usia 10-12 Tahun. *Jurnal Keolahragaan*, vol. 2, no. 1, 2014, 88-105.
- [18] Brenner, E., and Smeets, J. B. How Can You Best Measure Reaction Times?. *Journal of motor behavior*, vol. 51, no. 5, 2019, 486-495.
- [19] Del Rossi, G., Malaguti, A., and Del Rossi, S. Practice effects associated with repeated assessment of a clinical test of reaction time. *Journal of athletic training*, vol. 49, no. 3, 2014, 356-359.
- [20] Badau, D., Baydil, B., and Badau, A. Differences among three measures of reaction time based on hand laterality in individual sports. *Sports*, vol. 6, no. 2, 2018, 45-53.
- [21] Prasetyo, H., and Siswantoyo, M. Holding Bow Digital Test for Strength and Endurance Arm Muscles of Archery. In *2nd Yogyakarta International Seminar on Health, Physical Education, and Sport Science (YISHPESS 2018) and 1st Conference on Interdisciplinary Approach in Sports (CoIS 2018)*. Atlantis Press.
- [22] Delalija, A., and Babić, V. Reaction time and sprint results in athletics. *International Journal of Performance Analysis in Sport*, vol. 8, no. 2, 2008, 67-75.
- [23] Gierczuk, D., Lyakh, V., Sadowski, J., and Bujak, Z. Speed of reaction and fighting effectiveness in elite Greco-Roman wrestlers. *Perceptual and Motor Skills*, vol. 124, no. 1, 2017, 200-213.
- [24] Gürses, V. V., and Kaniş, O. The Relationship Between Reaction Time and 60 m Performance in Elite Athletes. *Journal of Education and Training Studies*, vol. 6, no. 12, 2019, 64-69.
- [25] Zemková, E., and Hamar, D. Agility performance in athletes of different sport specializations. *Acta Gymnica*, vol. 44, no. 3, 2014, 133-140.

# Technological Innovation with Visual and Auditory Stimulus

## Testing the Validity and Reliability

---

### ORIGINALITY REPORT

---

19%

SIMILARITY INDEX

12%

INTERNET SOURCES

10%

PUBLICATIONS

14%

STUDENT PAPERS

---

### PRIMARY SOURCES

---

1	<a href="http://www.bib.irb.hr">www.bib.irb.hr</a> Internet Source	2%
2	Submitted to University of Bedfordshire Student Paper	1%
3	Burcu Cinaz. "A Wearable User Interface for Measuring Reaction Time", Lecture Notes in Computer Science, 2011 Publication	1%
4	<a href="http://gymnica.upol.cz">gymnica.upol.cz</a> Internet Source	1%
5	<a href="http://journals.sagepub.com">journals.sagepub.com</a> Internet Source	1%
6	<a href="http://repository.unej.ac.id">repository.unej.ac.id</a> Internet Source	1%
7	Eli Brenner, Jeroen B. J. Smeets. "How Can You Best Measure Reaction Times?", Journal of Motor Behavior, 2018 Publication	1%

---



8	Submitted to Alamo Community College District Student Paper	1%
9	onlinelibrary.wiley.com Internet Source	1%
10	Submitted to CSU, Long Beach Student Paper	1%
11	www.ijhsr.org Internet Source	1%
12	www.mdpi.com Internet Source	1%
13	www.hindawi.com Internet Source	1%
14	thesis.binus.ac.id Internet Source	1%
15	Fakhani Berrezokhy, Uray Gustian, Isti Dwi Puspitawati. "ANALISIS KEMAMPUAN FISIK ATLET TINJU AMATIR KALIMANTAN BARAT", Jurnal Pendidikan Olahraga, 2020 Publication	1%
16	Submitted to Anglia Ruskin University Student Paper	<1%
17	L REICKER, T TOMBAUGH, L WALKER, M FREEDMAN. "Reaction time: An alternative method for assessing the effects of multiple	<1%

sclerosis on information processing speed",  
Archives of Clinical Neuropsychology, 2007

Publication

18

[www.brianmac.co.uk](http://www.brianmac.co.uk)

Internet Source

<1%

19

[lcluc.umd.edu](http://lcluc.umd.edu)

Internet Source

<1%

20

Submitted to University of Leeds

Student Paper

<1%

21

Gordon Muir Giles. "Assessing adaptive behaviour in the post-acute setting following traumatic brain injury: Initial reliability and validity of the Adaptive Behaviour and Community Competency Scale (ABCCS)", Brain Injury, 2009

Publication

<1%

22

Submitted to Cleveland Heights High School

Student Paper

<1%

23

Submitted to Coventry University

Student Paper

<1%

24

[benthamopen.com](http://benthamopen.com)

Internet Source

<1%

25

Submitted to Bournemouth University

Student Paper

<1%

26

Submitted to Universiti Teknologi MARA

<1%

27

[pinnacle.allenpress.com](http://pinnacle.allenpress.com)

Internet Source

<1%

28

Woods, David L., John M. Wyma, E. William Yund, and Timothy J. Herron. "The Effects of Repeated Testing, Simulated Malingering, and Traumatic Brain Injury on High-Precision Measures of Simple Visual Reaction Time", *Frontiers in Human Neuroscience*, 2015.

Publication

<1%

29

Dariusz Gierczuk, Vladimir Lyakh, Jerzy Sadowski, Zbigniew Bujak. "Speed of Reaction and Fighting Effectiveness in Elite Greco-Roman Wrestlers", *Perceptual and Motor Skills*, 2016

Publication

<1%

30

Cinaz, Burcu, Christian Vogt, Bert Arnrich, and Gerhard Tröster. "Implementation and evaluation of wearable reaction time tests", *Pervasive and Mobile Computing*, 2012.

Publication

<1%

31

Submitted to William Paterson University

Student Paper

<1%

---

Exclude quotes      On

Exclude matches      < 2 words

Exclude bibliography      On

# Technological Innovation with Visual and Auditory Stimulus

## Testing the Validity and Reliability

---

GRADEMARK REPORT

---

FINAL GRADE

**/100**

GENERAL COMMENTS

**Instructor**

---

PAGE 1

---

PAGE 2

---

PAGE 3

---

PAGE 4

---

PAGE 5

---

PAGE 6

---