

Gender Effect of Computer Based Testing and Traditional Mode of Testing on Students' Achievement in Developmental Psychology: A Case Study of Modibbo Adama University of Technology, Adamawa State, Nigeria

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Abstract

The area of educational assessment has adapted to the increased use of technology. Recent trends in assessment and technology include a movement from paper-based to computer-based testing for all types of assessments. With more teachers using technology in their classrooms to support instruction, it is expected that the shift to technology use would also happen with assessment. To this end, this study investigates the Gender Effect of Computer Based Testing (CBT) and Traditional Mode of Testing on Students' Achievement in Developmental Psychology in Modibbo Adama University of Technology, Adamawa State. The ex post facto research design was adopted for the study. The sample for this study was 23 (700 level) students enrolled in Master's programme in Educational Psychology, 2017/2018 session, at the Department of Environmental and Life Science Education, Modibbo Adama University of Technology, Yola. The purposive and stratified random sampling techniques were used to select students engaged in the study. The instrument used for data collection was a 20-item multiple choice Developmental Psychology Achievement Test (DPAT) questions. The instrument was scrutinized and validated by experts in Test and Measurement. The internal consistency of the test items was 0.78 using Cronbach alpha statistic. Descriptive statistics of mean and standard deviation were used to answer the research questions, while the hypotheses were tested using t-Test statistic. The study revealed that CBT was better than traditional mode of testing in improving students' achievement in developmental psychology. Students' gender did not affect their achievement in CBT and traditional assessments. The study recommended that teachers should incorporate CBT with traditional mode of testing in order to motivate students to learn and improve their academic achievement.

Keywords: Gender, Students' Achievement, CBT and Traditional Mode of Testing, Developmental Psychology

1. INTRODUCTION

Recent trends in assessment of learning achievement have involved a movement from paper-based to computer-based testing (CBT) (Pellegrino & Quellmalz, 2010; Hensley, 2015). CBT can be defined as a method of using computers to deliver tests or examinations (Graff, 2003). These are assessments that are completed using the computer, either through a computer programme or through a web-based system (Hensley, 2015). The CBT platforms offer many possibilities to conduct effective assessments, both formative and summative assessment tests. There are some obvious advantages to CBT, including increased students' motivation, improved accuracy in data collection, improved match for special populations, and fast reporting of results (Kapoor & Welch, 2011; Poggio & McJunkin, 2012). Studies have also found that students enjoy taking CBT and are motivated by the use of technology (Bodmann & Robinson, 2004; Ripley, 2009). The quick reporting of results is particularly useful to educators as they are able to access and use these results to make timely changes in instruction if necessary (Bennett, 2003; Peak, 2005; Poggio & McJunkin, 2012; Dean & Martineau, 2012). Further to this, Yam and Rossini (2013) gave elaborate advantages of CBT which include: (i) the assessment scores are immediate and provide a real image of the students' progress. (ii) Students can receive feedback for each question. (iii) The opportunity to repeat the quiz, providing students not only the correct answer but also references. (iv) The possibility for teachers to analyze the time spent on each question and the history of responses in order to identify difficulties and pattern of responses. (v) CBT of learning and assessment encourage independent learning and self-evaluation. (vi) CBT of learning and assessment help students to

develop effective time management strategies. However, one pertinent question to ask is will these merits of CBT tell on students' achievement in an educational psychology class?

Despite the merits of CBT, it is not without its disadvantages. Regarding the demerit of CBT, the most important aspect refers to the difficulties or the lack of ability for the usage of computers, especially for the students from the non-technical disciplines (O'Rourke, 2013). CBT can be time consuming because it require from the teachers technical knowledge and additional training to become familiar with the development of questions in e-learning (O'Rourke, 2013). Will these disadvantages act as impediments to success of students in an educational psychology class?

Traditionally, assessment has been administered using paper-based tests (Hensley, 2015), meaning that pages of problems were given to the students for them to complete using writing materials. Studies have found high levels of reliability and validity using traditional assessment (Lembke, Hampton, & Beyers, 2012). These measures have also been found to be repeatable, sensitive to students' growth over time, and helpful to educators in making decisions about what to teach (Shapiro, 2004). However, there are some issues that arise in the use of traditional assessment, including printing costs, administration time, and consistency of scoring (Hensley, 2015). On the aspect of consistent scoring, measures scored by teachers can lead to inconsistent or incorrect scoring practices (Fuchs, Fuchs, & Hamlett, 1994). Nonetheless, it is not enough to rely on this without empirical evidence.

Developmental Psychology is one of the courses offered by students enrolled for the Master's programme in Educational Psychology at the Department of Environmental and Life Science Education in Modibbo Adama University of Technology, Yola. Students in this Department are basically exposed to the traditional face-to-face mode of assessment. However, due to the greater flexibility of the CBT to both students and lecturers, some lecturers have opted for the use of CBTs as supplements of the traditional mode of testing students' learning achievements. Will these two different modes of assessments of leaning achievements by lecturers have significant effect on students' learning achievement in Developmental Psychology? This is the main thrust of this study?

In addition to the possible differences in postgraduate students' achievement in Developmental Psychology as a result of different modes of assessment of learning achievement, the students' gender could also be factored in. Previous studies have reported inconsistent results areas regards gender effect on students' achievement (Clariana & Wallace, 2002; Poggio, Glasnapp, Yang, & Poggio, 2005; Horkay, Bennett, Allen, Kaplan & Yan, 2006; Hensley, 2015). Even though Hensley (2015) results indicate that females outperformed males in computer based assessment, the mean was however statistically insignificant. To further buttress this result, Clariana and Wallace (2002), when examining multiple choice course examinations, found no difference in CBT and traditional assessment results between male and female students. Similar results were found in a study conducted by Horkay, et al. (2006) and Poggio, et al. (2005). However, will a similar result be obtained in CBT and traditional mode of testing of students in developmental psychology based on gender? This is a critical question that this study was designed to answer.

The number of studies comparing students' achievement in CBT versus traditional face-to-face assessment continues to grow. The majority of these show no significant difference in the achievement of CBT versus traditional on-campus students (Russell, 1999; Fredda, 2000; Dutton et al., 2001, Lorenzetti, 2005). Studies in the field of geography show similar results (Jain & Getis, 2003; Winkler Prins Weisenborn, Groop, & Arbogast, 2007). Dutton, et al. (2001) compared the results between different CBT deliveries modes of study each year as well as between different classes over the 4-year period. Traditional mode students achieved a slightly better result in examinations in comparison with CBT mode students. However, there are few studies in educational psychology comparing the effectiveness of CBT versus traditional mode of testing.

Numerous assessment suites have created computer-based assessments which include: AIMSweb, Data Director, easyCBM, mCLASS, FastBridge, and Yearly Progress Pro (Hensley, 2015). The benefits of e-assessment for learners refer to several aspects. There are many advantages for educators using these CBT as earlier stated, some of which include, automatic scoring, options of displays, and immediate logging of scores (Bridgeman, 2009; Redecker & Johannessen, 2013). All these are not options for traditional assessment. Cezan and Indereica (2014) reported a high satisfaction of students for the CBT. This is in contrast with previous

research which revealed a negative attitude of students towards CBT assessment due to difficulties or lack of ability for the usage of computers, especially the students from nontechnical disciplines (O'Rourke, 2013). In an attempt to alleviate these issues, the study investigates the gender effect CBT and Traditional Mode of Testing on students' achievement in developmental psychology.

1.2 Purpose of the Study

The intent of this study was to investigate the gender effect of CBT and Traditional Mode of Testing on students' achievement in developmental psychology. The objectives of the study were enumerated as follows:

- (i) to determine the variations in academic achievement of students in developmental psychology using CBT and Traditional Mode of Testing.
- (ii) to establish the differences in the mean score of Male and Female students in developmental psychology using CBT.
- (iii) to establish the differences in the mean score of Male and Female students in developmental psychology using Traditional Mode of Testing.

1.3 Research Questions

The following research questions were formulated to guide the study.

- (i) What is the mean score of students in developmental psychology using CBT and Traditional Mode of Testing?
- (ii) What is the mean score of Male and Female students in developmental psychology using CBT?
- (iii) What is the mean score of Male and Female students in developmental psychology using Traditional Mode of Testing?

1.4 Hypotheses

The following null hypotheses were posed and were tested at 0.05 level of significance:

- H₀₁:** There is no statistically significant difference in the mean score of Male and Female students in developmental psychology using CBT.
- H₀₂:** There is no statistically significant difference in the mean score of Male and Female students in developmental psychology using Traditional Mode of Testing.

2. MATERIALS AND METHODS

This study adopted the ex post facto research design. Ex post facto design do not allow for explicit finding of causation (Fraenkel & Wallen, 2006), but do strongly suggest whether mode of testing had a direct gender effect on students' learning. Additionally, since ex post facto design takes place after data were collected and without any manipulation or interventions, it allows for the exploration of naturally occurring differences between the two modes of assessments. In this research, the traditional and CBT modes of testing was adopted in order to evaluate the gender effect of the CBT as well as traditional mode of testing.

The sample for this study was 23 post graduate students enrolled in the 2017/2018 Master's programme in Educational Psychology, of the Department of Environmental and Life Sciences Education, Modibbo Adama University of Technology, Yola, Adamawa State. Out of the 23 students, 10 were male while 13 were female. All of which offer the course developmental psychology, thus, finite population of the students was used for the study. The students had already been exposed to concepts in developmental psychology; therefore, the study was primarily carried out to know how students will perform when exposed to CBT and traditional mode of testing concurrently.

The researchers constructed a Developmental Psychology Achievement Test (DPAT), which consisted of 20 multiple choice items. The instrument (DPAT) has items validity which is concerned with whether the test items are relevant to the measurement of intended content areas and sampling validity which is also concerned with how well the test samples the total content area being tested. More so, face and content validities were carried out by test experts in Test and Measurement in the Department of Education, Gombe State University, and Modibbo Adama University of Technology, Yola, Adamawa State. The internal consistency of the test items was 0.78 using Cronbach alpha statistic. The mean difficulty index (p) value and DI were 51.41% (SD 19.32%) and 0.24 (SD 0.15), respectively. DI was noted to be a maximum at a p-value range between 40 and 60%. Mean

DE was 50.40% (SD 20.90%). Items having average difficulty and high discriminating power with functional distractors should be integrated into future tests to improve the quality of the Developmental Psychology test. Using DI, it was observed that 15 (75%) of the test items fell into the reasonably good or acceptable value ranges. The traditional mode of testing was first administered to the students, a week later; CBT was also administered to them in order to examine the gender effect of CBT and Traditional mode of testing on students' achievement in Development Psychology. Descriptive statistics of mean and standard deviation were used to answer research questions One to Three, while Hypotheses One and Two were tested using t-Test statistic. All tests were done using Statistical Package for Social Sciences (SPSS) version 21, and the probability value of $p < 0.05$ was considered statistically significant.

3. RESULTS

Research Question One: What is the mean score of students in developmental psychology using CBT and traditional mode of testing? This question was answered using descriptive statistics of students' mean score in developmental psychology exposed to CBT and Traditional mode of testing. The result is presented in Table 1.

Table 1: Descriptive Statistics of Students' Mean Score in Developmental Psychology using CBT and Traditional Mode of Testing

Variable	N	Mean	Std. Dev.
CBT	23	15.17	2.98
Traditional Mode of Testing	23	12.09	2.13

Table 1 shows the descriptive statistics of students' mean score in developmental psychology using CBT and Traditional Mode of Testing. From the table, it could be seen that students performed better in CBT ($M = 15.17$) compared with Traditional Mode of Testing (12.09). This scenario could also be depicted graphically in Figure 1.

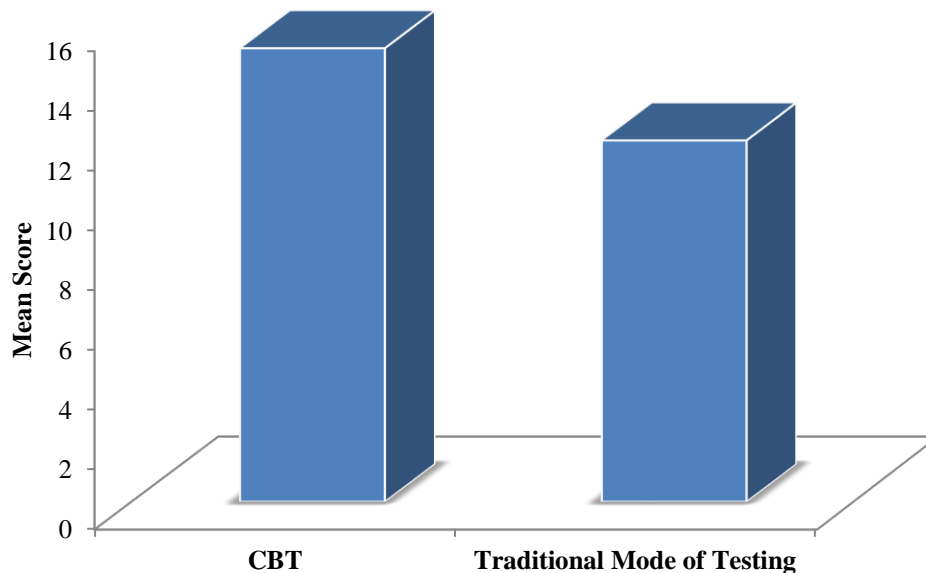


Fig. 1: A Bar Graph Showing Students' Mean Score in Developmental Psychology using CBT and Traditional Mode of Testing

Research Question Two: What is the mean score of Male and Female students in developmental psychology using CBT? This question was answered using descriptive statistics of Male and Female students' mean score in developmental psychology exposed to CBT mode of assessment. The result is presented in Table 2.

Table 2: Descriptive Statistics of Male and Female Students in Developmental Psychology using CBT

Variable	Gender	N	Mean	Std. Dev.
CBT	Male	10	14.90	3.03
	Female	13	15.38	3.04

Table 2 indicates the descriptive statistics for Male and Female students in developmental psychology using CBT. The result shows that Female students had a higher mean ($M = 15.38$) score in CBT compared to their Male counterparts ($M = 14.90$). In order to know whether these means were significant, it was further subjected to independent samples t-Test as illustrated in Tables 3.

Ho₁: There is no statistically significant difference in the mean score of Male and Female students in developmental psychology using CBT.

Table 3: Summary of t-Test Analysis of Male and Female Students' Mean Score in Developmental Psychology using CBT

Variable	N	Mean	SD	df	t	Sig. (2-tailed)
Male	10	14.90	3.03	21	0.379	.708
Female	13	15.38	3.04			

Not Significant; $p > 0.05$

The results obtained from the t-Test analysis of Male and Female students' mean score in developmental psychology using CBT indicate no statistically significant difference in the mean score of Male and Female students ($t = 0.379$, $df = 21$; $p = 0.708$). This implies that the achievement of students in developmental psychology using CBT is not predicated on gender.

Research Question Three: What is the mean score of Male and Female students in developmental psychology using Traditional Mode of Testing? This question was answered using descriptive statistics of Male and Female students mean score in developmental psychology exposed to Traditional Mode of Testing. The result is contained in Table 4.

Table 4: Descriptive Statistics for Male and Female students in Developmental Psychology using Traditional Mode of Testing

Variable	Gender	N	Mean	Std. Dev.
Traditional Mode of Testing	Male	10	12.90	2.025
	Female	13	11.46	2.066

Table 4 indicates the descriptive statistics for Male and Female students in developmental psychology using Traditional Mode of Testing. The result shows that the mean score of Female students was lower ($M = 11.46$) compared to that of their Male counterparts ($M = 12.90$). In order to know whether these means were significant, it was further subjected to independent samples t-Test as presented in Table 5.

Ho₂: There is no statistically significant difference in the mean score of Male and Female students in developmental psychology using Traditional Mode of Testing.

Table 5: Summary of t-Test Analysis of Male and Female Students' Mean Score in Developmental Psychology using Traditional Mode of Testing

Variable	N	Mean	SD	df	t	Sig. (2-tailed)
Male	10	12.90	2.025	21	1.669	.110

Female	13	11.46	2.066
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Not Significant; $p > 0.05$

The data obtained from the t-Test analysis of Male and Female students' mean score in developmental psychology using Traditional Mode of Testing indicate no statistically significant difference ($t = 1.669$, $df = 21$; $p = 0.110$). This implies that the achievement of students in developmental psychology using Traditional Mode of Testing is not based on gender.

4. DISCUSSION

The area of educational assessment has adapted to the increased use of technology. Recent trends in assessment and technology include a movement from paper-based to computer-based testing for all types of assessments. With more teachers using technology in their classrooms to support instruction, it is expected that the shift to technology use would also happen with assessment.

In this study, the mean score of students in developmental psychology using CBT and Traditional Mode of Testing were compared. The result reveals difference in the mean score of students in developmental psychology when exposed to CBT and Traditional Mode of Testing concurrently. This implies that students achieved better results in CBT test than in paper and pencil DPAT. Kapoor and Welch (2011), Poggio and McJunkin (2012) reported some obvious advantages to CBT assessment, including increased students' motivation, improved accuracy in data collection, improved match for special populations, and fast reporting of results. Furthermore, studies have also found that students enjoy taking CBT assessment and are motivated by the use of technology (Bodmann & Robinson, 2004; Ripley, 2009). On the contrary, this result is in contrast with the works of other researchers (Russell, 1999; Fredda, 2000; Dutton, et al., 2001, Lorenzetti, 2005) which show no significant difference in the achievement of students using CBT and Traditional Mode of Testing. The finding is also at variance with the study of Dutton, et al. (2001), which reported that students exposed to Traditional Mode of Testing achieved a slightly better result in examinations when compared with achievement in CBT. Cezan and Indereica (2014) reported a high satisfaction of students for the CBT assessment. This could be the reason why students engaged in this study achieved a remarkable result when exposed to CBT.

Gender is the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine (female and male) population (Filgona & Sababa, 2017). It could also be one the factors that determines students achievement. In this study, the achievement of students in developmental psychology based on gender using CBT and Traditional Mode of Testing was compared. The analysis showed no significant difference in the achievement of students based on gender. This is an indication that students' gender could not be factored in their achievement in developmental psychology using CBT and traditional assessments. This further goes to show that CBT and Traditional Mode of Testing are gender-friendly. This finding coincided with the works of Hensley (2015); Horkay, et al. (2006), Poggio, et al. (2005). These authors proved that students' gender was not a factor in their achievement using CBT and Traditional Mode of Testing. To further buttress this result, Clariana and Wallace (2002), when examining multiple choice course examinations, found no difference in CBT and traditional assessment results between male and female students.

5. CONCLUSION

The study had shown that CBT assessment was effective in improving students' achievement in developmental psychology compared to the traditional assessment. This could be tied to the numerous advantages of CBT assessment over the Traditional Mode of Testing. Students were motivated and excited when they were exposed to this technology-based testing. Furthermore, there was no variation in the achievement of male and female students using CBT and traditional mode of testing. This implies that both male and female students are highly motivated towards the use of technological-based as well as traditional face to face testing.

6. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1. Schools should be equipped with computers and internet facilities to promote the use of CBT.
2. There should be constant power supply. This may encourage teachers to integrate CBT with traditional mode of assessing students.



3. This research study is a further step towards assisting universities in helping students determine if CBT learning is an effective medium of learning for each student. Both male and female students should be given equal opportunity to learn.

7. LIMITATIONS OF THE STUDY

Despite an increase in the achievement of students in CBT compared to Traditional Mode of Testing, the improvement may not be completely tied to the exposure of students to the modes of assessment; this means that the influence of other factors may not be completely ruled out. Therefore, an experimental study could further be conducted to determine the efficacy of the CBT.



REFERENCES

- Bennett, R. E. (2003). *CBT assessment and the comparability of score meaning*. Princeton, NJ: Educational Testing Service.
- Black, P., & William, D. (1998). Assessment and classroom learning. *Assessment in Education*, 5(1), 28-43.
- Bodmann, S. M., & Robinson, D. H. (2004). Speed and performance differences among computer-based and paper-pencil tests. *Journal of Educational Computing Research*, 31(1), 51-60.
- Bridgeman, B. (2009). Experiences from large-scale computer-based testing in the USA. In F. Scheurmann, & J. Bjornsson (Eds.), *The transition to computer-based assessment* (39-44). Luxembourg, Office for Official Publications of the European Communities.
- Cezan, A. M., & Indereica, S. E. (2014). *Traditional assessment of learning versus CBT assessment*. A paper presented at the 10th international scientific conference. E-learning and software for education, Bucharest, Romania, April 24-25.
- Clariana, R., & Wallace, P. (2002). Paper-based versus computer-based assessment: Key factors associated with the test mode effect. *British Journal of Educational Technology*, 33(5), 593-602.
- Dean, V., & Martineau, J. (2012). A state perspective on enhancing assessment and accountability systems through systematic implementation of technology. In R. W. Lissitz, & H. Jiao (Eds.), *Computers and their impact on state assessments* (25-53). Charlotte, NC; Information Age Publishing, Inc.
- Department of Education and Early Childhood Development. (2008). *Prep to year 10 assessment: Assessment advice*. DEECD, Melbourne. Retrieved 26th June, 2018, from <http://www.education.vic.gov.au/studentlearning/assessment/preptoyear10/assessadvce/default.htm#purpose>.
- Dutton, J., Dutton, M., & Perry, J., (2001). Do CBT students perform as well as lecture students? *Journal of Engineering Education*, 90(1).
- Earl, L., & Cousins, J. B. (1995). *Classroom assessment: Changing the face, facing the change*. Toronto, Canada: Ontario Public School Teachers Federation.
- Fredda, J., V., (2000). Comparison of selected student outcomes for internet versus campus based instruction, *Nova Southeastern University Research and Planning Report* 00- 08, ERIC Document Reproduction Service No. ED443374.
- Filgona, J. & Sababa, L. K. (2017). Effect of gender on senior secondary school students' academic achievement in geography in Ganye educational zone, Nigeria. *European Journal of Education Studies*, 3(4), 394-410.
- Fuchs, L. S., Fuchs, D., & Hamlett, C. L. (1994). Strengthening the connection between assessment and instructional planning with expert systems. *Exceptional Children*, 61, 138-146.
- Graff, M. (2003). Cognitive style and attitudes towards using CBT learning and assessment methods. *Electronic Journal of e-learning*, 1(1), 21-28.
- Hensley, K. K. (2005). *Examining the effects of paper-based and computer-based modes of assessment on mathematics curriculum-based measurement*. Unpublished Ph.D Thesis, University of Iowa, Iowa, USA.



- Horkay, N., Bennett, R. E., Allen, N., Kaplan, B., & Yan, F. (2006). Does it matter if i take my writing test on computer? An empirical study of mode effects in NAEP. *Journal of Technology, Learning, and Assessment*, 5(2), 2.
- Jain, C., & Getis, A. (2003). The effectiveness of internet based instruction: an experiment in physical geography, *Journal of Geography in Higher Education*, 27(2), 153 – 167.
- Kapoor, S., & Welch, C. (2011). *Comparability of paper and computer administrations in terms of proficiency interpretations*. Paper presented at the 2011 Annual Meeting of the National Council on Measurement in Education, New Orleans, LA. Retrieved 26th June, 2018, from <https://itp.education.uiowa.edu/ia/documents/Comparability%20of%20Paper%20and%20Computer%20Administrations%20in%20Terms%20of%20Proficiency%20Interpretations.pdf>.
- Lembke, E. S., Hampton, D., & Beyers, S. J. (2012). Response to intervention in mathematics: Critical elements. *Psychology in the Schools*, 49(3), 257-272.
- Lorenzetti, J. P. (2005). Secrets of CBT success, lessons from the community colleges. *Distance Education Report*, 9(113).
- O'Rourke, M. (2013). *The development of CBT assessment in the moodle virtual learning environment (VLE) as a replacement for traditional written assessment*. Retrieved 26th June, 2018, from <https://dspace.ndlr.ie/bitstream/10633/5523/1/EdTech%202010%20paper.pdf>fat19.02.2014.
- Peak, P. (2005). *Recent trends in comparability studies*. Pearson Educational Measurement.
- Pellegrino, J. W., & Quellmalz, E. S. (2010). Perspectives on the integration of technology and assessment. *Journal of Research on Technology in Education*, 43(2), 119-134.
- Poggio, J., Glasnapp, D. R., Yang, X., & Poggio, A. J. (2005). A comparative evaluation of score results from computerized and paper & pencil mathematics testing in a large scale state assessment program. *The Journal of Technology, Learning and Assessment*, 3(6).
- Poggio, J., & McJunkin, L. (2012). History, current practice, perspectives and what the future holds for computer based assessment in K-12 education. In R. W. Lissitz & H. Jiao (Eds.), *Computers and their impact on state assessments* (25-53). Charlotte, NC; Information Age Publishing, Inc.
- Redecker, C., & Johannessen, O. (2013). Changing assessment: Toward a new assessment paradigm using ICT. *European Journal of Education*, 47(1), 79-95.
- Ripley, M. (2009). Transformational computer-based testing. In F. Scheurmann & J. Bjornsson (Eds.), *The transition to computer-based assessment* (89-91). Luxembourg, Office for Official Publications of the European Communities.
- Russell, T. L. (1999). *The no significant difference phenomenon*. Raleigh, NC, North Carolina State University.
- Stiggins, R. (1997). *Student-centred classroom assessment*. NJ: Prentice Hall.
- WinklerPrins, A., Weisenborn, B. N., Groop, R. E., Arbogast, A. F. (2007). Developing CBT geography courses: Experiences from Michigan State University. *Journal of Geography*, 106, 163 – 170.
- Yam, S., & Rossini, P. (2013). *CBT and traditional formative assessment: Experience from a first-year course*. A paper presented at 19th Annual Pacific-Rim Real Estate Society Conference, Melbourne, Australia, 13-16 January.