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Effects of Individual Differences on the Performance in Computer Based Test (CBT)

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Abstract. Along with the advancement of technology, the usage of Computer-Based Test (CBT) is increasing. However, many problems emerge due to this matter, such as equivalency issue which has been widely examined. Another emerging critical issue is its relation with individual differences aspect of test takers which affects their performance in completing Computer-Based Test (CBT). This article aimed at reviewong various research pertaining to the individual differences aspect affecting performance in the usage of CBT. The method used in this literature review was systematic review which, according to Galvan, consists of three main steps, namely searching, reviewing, and writing the result of literature review. The total number of literature reviewed was 21, where 20 of them were empirical research and another one was a review. The result showed that there were some individual difference factors which influence performance in CBT. Those factors were (1) Test Anxiety, (2) Computer Anxiety, (3) Computer Self-Efficacy, and (4) Testing Motivation. From those four individual difference aspects being reviewed, it can be inferred that all of them had impact on performance in CBT. Three aspects, namely test anxiety, computer anxiety, and testing motivation had direct effect on test performance. Meanwhile, computer self-efficacy indirectly affected test performance

Keywords: Individual differences, computer based test (cbt).

INTRODUCTION

Information and Communication Technology (ICT) advancement is often utilized to support educational process. Its utilization includes usage during learning-teaching process and the use of computer-based assessment. Along with ICT advancement, various forms of assessments make use of technology. One of them is Computer-Based Test (CBT). CBT is an advanced "innovative" approach for assessment. In Indonesia, the implementation of CBT has been increasingly progressing in the last five years. Among such implementation are the usage in Computer-Based National Examination (*Ujian Nasional Berbasis Komputer/* UNBK) and in some admission examinations for state universities. In the future, these utilizations will increase because of some advantages and ease of CBT. Similar to the opinion of Redecker (2013), CBT is generally used to improve efficiency and effectiveness in test administration. In addition, CBT is also used to enhance the validity and reliability of test score. Meanwhile, in term of student aspect, CBT utilization can increase their motivation, concentration, and performance.

There are some issues emerging due to to the implementation of CBT. Not all test takers are ready to face it. Evaluation, test, or examination for school and university students is deemed as something eliciting anxiety or something frightening. It will be even more so when The administration model differs from the usual, or in this case, when conventional paper-based examination is replaced by examination which utilizes computers. It will surely have psychological impacts on the test takers. Some years ago, issues regarding equivalency were examined and numbers of researches proved that there was no score difference between CBT and paper-based test (PBT). It means that the implementation of CBT can be accepted. Additionally, some other studies also discussed that there are various psychological aspects which occurred to test takers and it is not impossible that they will affect test takers' performance in CBT. Some researches indicated many individual difference aspects related to performance in CBT, such as test anxiety, computer anxiety (Lu, Hu, Gao, & Kinshuk, 2016), computer self-efficacy , and testing motivation.

The Concept of Computer-Based Testing

Along with technology advancement, the term of Computer-Based Testing (CBT) is used more often in evaluation process. Other similar terms which are usually found are Computer-Based Assessment (CBA), Computer Adaptive Testing (CAT), and Computer-Based Exam (CBE). Based on a review of some journal articles, the general idea of CBT is a kind of test developed in a computer-based system using a particular program. In the research, the program being used was visual basic program (Piaw Chua, 2012). Meanwhile Khodaie, Moghadamzadeh, and Salehi (2011) defined CBT as a computer-based test which uses a particular computer program. In their research, they used Hypercard version 122 program and it was administered on Macintosh microcomputer. On the other side, another term which has closely similar meaning is Computer-Based Assessment (CBA). CBA is defined as the application of ICT for evaluation related to tasks (A, Razak, Bin, & Adenuga, 2016). Meanwhile, Terzis and Economides (2011) defined CBA as an ICT-based assessment system. Furthermore, CBA can be categorized into formative and summative assessment. Summative assessment helps deciding whether students have achieved the predetermined objectives. Formative assessment provides feedback to help students achieving those objectives (Birenbaum, 1996; Economides 2006, 2009; Moridis & Economides, 2009a).

Another CBT and CBA-related term is Computer-Based Exam (CBE), which is an exam that makes use of computer (Boevé, Meijer, Albers, Beetsma, & Bosker, 2015). In a study by Boeve and associates (2015), the process used was through Nestor, the questions were displayed one by one, and navigation through the exam was in separated window with the number of the questions allowing students to review and change their answers to other questions. For both exam, therefore, students had opportunities to go back and change their answers at any point and as many as they like before submitting their final answers. After submitting the final answers for both midterm examination and final examination in computer-based modes, students could directly indicate how many questions they had got right.

Based on the aforementioned definitions from various researches in some journal articles, it is fair to conclude that the similarity between CBT, CBA, and CBE is that they all use computer. Meanwhile, the difference between CBA, CBT, and CBE is a width of the scope of evaluation or assessment process. CBT indeed emphasizes the test which the test takers take, with various aims. On the other hand, CBE emphasized the test which has special aim, namely for examination. CBA has a wider scope because it is related to general assessment. As stated by Terzis and Economides (2011), CBA can be categorized into summative and formative assessment. Hence, it can take many forms such as an assessment, a test, or an examination.

The Concept of Individual Differences

According to Vispoel, Rocklin, and Wang (1994), there are many individual difference variables being examined in term of their relation with score validity of an alternative model of test administration. Those variables include personality (e.g. test anxiety, self-concept, locus of control, and risk taking), attitude (e.g. toward a particular item format, toward a particular content, and toward computer), demographical characteristics (e.g. sex, ethnicity, socioeconomic status), et cetera. Based on previous theory and research, Vispoel and colleagues (1994) had chosen four variables related to individual differences (i.e. test anxiety, academic self-concept, computer anxiety, and computer usage). Each of these is expected to be correlated with the test administration method, or in this case, a method that makes use of computer.

The Concept of Performance Test

The term performance test differs from test of performance. Performance test is more of description of a test result, which usually related to score. Meanwhile, test of performance is a test which assesses individual's performance. It is generally related to particular skill or expertise. In general, the definition of performance test is never explicitly explained in journal articles despite its usual position as important variable. In some journal articles which studies test result, they used various terms which have similar meanings. The terms used were performance test, student performance, achievement score, actual performance, and exam performance. Akdemir and Oguz (2008) termed Student Performance which they defined as score in a score of both CBT or PBT in some courses. The same term was used by Boevé and associates (2015) who defined Student Performance as examination result which was done by students who took a particular course, in that study it was Biopsychology course. Furthermore, the Performance Test term was also used by Piaw Chua (2012), (Shermis & Lombard, 1998), (Wise, Barnes, Harvey, & Plake, 1989) , and M. Llabre, Nancy E. Clements, and Katha (1991). Those researchers defined Performance Test as the score of a test. However, the test used in those studies were varied from a psychological scale to achievement test or test which assessed capability. Scales were used by Piaw Chua (2012) who administered Yanpiaw Creative-Critical Styles test (YBRAINS), Llabre, Nancy E. Clements, and Katha (1991) who used *the California Short-Form Test of Mental Maturity* (CMM) and TAS-R. Achievement tests were a test for algebra skill (Wise et al., 1989) and a placement test (Shermis & Lombard, 1998). Both test were time-limited tests. Another term used is Achievement Score which is a score obtained in an achievement test (Christine H.L Cin, J Stuart Don, &Robert F Conry, 1991). Also, there is Actual Performance term, which is a test score assessed by estimating the skill using maximum likelihood procedure (Tonidandel, Quiñones, & Adams, 2002).

The similarity of those definitions is that they all refer to the score resulting from a particular test. It is fair to infer that performance test is a score resulting from a test. Test, in this context, includes both psychological test and achievement test, both power test and speed test. Meanwhile, the difference among them is only about the test being used, as already explained above that the test used includes psychological test and achievement test. Pertaining to performance test in CBT, according to McDonald (2002), performance test is a result from interaction between the test taker and the test itself, which in this context, the key aspect is whether the test is paper-based or computer-based. From this interaction, individuals' experience also comprises of the situation during administration which may vary depending on some factors, including the test format and their reaction toward this. If the reaction varies among individuals as a result of the varied test format, then it may also influence the construct being assessed by each test and test equivalency. Reaction toward test results from individual differences among test takers. Based on this fact, author expects that individual differences have impact on performance test in CBT.

The research question formulated is "Do Individual differences: (1) Test Anxiety, (2) Computer Anxiety, (3) Computer Self Efficacy, (4) Testing Motivation influence result of performance test in CBT?"

METHOD

The method of literature review was systematic review. The review process follows three main steps as explained by Galvan (2006 cited in Gikandi, Morrow, & Davis, 2011), namely, searching, reviewing, and writing the literature review result.

1. Literature Search

The information was obtained by using Computer-Based Test, Individual Differences, Performance, and Psychological Aspect as keywords. The databases used in the search were ERIC, ProQuest, Science Direct, and Google Scholar. The search was conducted for studies in the last two decades wherein the advancement and usage of digital technology for education have been widely and quickly developed. From the search, 21 relevant articles were obtained. Articles were of various sources, namely Computers and Education, Computers in Human Behavior, Educational and Psychological Measurement, Computers in Human Behavior, Assessment & Evaluation in Higher Education, Plos One, Journal of Educational Computing Research, Applied Measurement in Education, Journal of Applied Psychology, European Journal of Psychological Assessment, Journal of Theoretical and Applied Information Technology, Psychological Thought, Procedia: Social and Behavioral Science and ergonomic. The collected articles had various degree of relevance to the theme being examined. A number of proceeding and dissertation by researchers which were related to CBT was considered as secondary sources. Meanwhile, Mendeley was used for reference management.

2. Literature Review

This step involves skimming the selected articles, sorting them according their publication date (1989-backwards), and expansion of relevance with the research theme. Some selected articles were classified into primary (empirical) study and secondary source, allowing for preference to review empirical studies. Author reviewed the literature search. The review process was guided by the focus of the problem, where the themes of each article were recorded in order to identify articles whose focus was relevant with the theme that author had identified as the core concept of the individual difference aspects affecting performance in CBT. Those core themes included main features of individual differences, such as: (1) Test Anxiety, (2) Computer Anxiety, (3) Computer Self-Efficacy, and (4) Testing Motivation. Another key criterion was that the main focus of author was specifically on individual differences in the implementation of CBT in educational context, both in higher education and lower level. During the review process, author also identified and chose, among 40 articles being reviewed, 21 articles where 20 of them were empirical studies. Those articles specifically focused on the effect of individual differences in the usage of CBT in educational context. Therefore, those twenty (20) empirical studies were regarded as the core of this review.

These key empirical studies were conducted between 1989 and 2016. In order to deeply explore our main focus, we conducted the research and then extracted...

3. Writing the Literature Review

In this step, author reviewed the brief note, which had been made and referred to the selected key empirical studies in order to write a detailed analysis. The first step was to critically analyze the methodological approach, strength and limitation, key findings, implication, and conclusion of each empirical study. These aspects were consudered as effective criteria to decide the quality of literatures (Cahan, 2006, Pan, 2008 cited in Gikandi et al., 2011). This idea was systematically developed to inform the important themes and implication and was shown in Table 1.

Table 1. Recapitulation of Literature Review Result

Author(s) and Year	Aspect of Individual Differences	Result	Subject(s)	Result related to Performance	Model Study	Research Method
(Wise et al., 1989)	• Computer anxiety • Computer experience	MANOVA with Computer Anxiety as a blocking variable showed significant multivariate effect of Computer Anxiety.	100 students, 24 males and 76 females.	Students with high Computer Anxiety obtained lower score in Algebra test	CBT and PBT	Field Experiment
(M. Llabre, Nancy L. Clements, 2000)	• Test Anxiety	There was Test Anxiety difference between CBT and PBT	16 males, 14 female students			Field Experiment
Christine H.L Cin, J Stuart Don, Robert F Conry (1991)	• Attitude toward CBT • Computer Anxiety • Computer Experience • Test Anxiety	1. No significant difference in Test Anxiety between PBT group and CBT group. 2. No significant correlation between Computer Experiment and Computer Anxiety	10 Class learners, 54 male students, 51 female students	Mean of performance score in CBT was higher than in PBT	CBT and PBT	Experiment
(Vispoel et al., 1994)	• Test Anxiety • Computer Anxiety • Verbal self-concept • Computer Usage	1. Amon three kinds of test, the most efficient was CAT, followed by SAT and FIT. 2. Estimation of Ability and Test Anxiety significantly correlated in SAT condition (r = -17, p> 14), but both were closely correlated in CAT (r = - .38, p <.01) and FIT (r = --45, p <.001).	121 psychology students, age average was 20.88 years.	Test Anxiety was negatively correlated with performance in various situation of test / evaluation.	FITs, CATs, and SATs	Field Experiment
(Shermis & Lombard, 1998)	• Test anxiety • Computer anxiety • Personality	1. No score difference in Test Anxiety between male and female. 2. Computer Anxiety was negatively correlated with reading score. 3. Only in thinking-feeling dimension, there was statistically significant difference of Computer Anxiety	72 university students, consist of 52 females and 20 males.	There was negative correlation between Test Anxiety and mathematics score. There was negative correlation between Computer Anxiety and reading score.	CBT	Experiment
Tonidandel et al., 2002)	Reaction of test takers, including: • Motivation • Anxiety • Satisfaction • Perceived fairness • Self-efficacy • Feedback Acceptance	1. Objective test difficulty positively predicted perceived performance, regardless of decision making ability. 2. Perceived performance in this test would mediate the correlation between objective test difficulty and learning motivation. 3. Perceived performance could not mediate the relation between objective test difficulty and Test Anxiety. 4. Perceived performance mediated the relation between objective test difficulty and satisfaction. 5. Perceived performance could not mediate the correlation between objective test difficulty, attribution, and self-efficacy.	63 males and 99 females.	No significant correlation between perceived performance and anxiety.		Experiment with 3x3 design
(McDonald, 2002)	• Computer familiarity • Computer anxiety • Computer attitudes	The importance of exploring individual differences which affect the equivalency of CBT and PBT.		Result showed that computer anxiety could negatively impact the result of test. Interaction between computer and test takers was considered as potential source for anxiety (for instance misalnya Gallagher &		Literature Review

Author(s) and Year	Aspect of Individual Differences	Result	Subject(s)	Result related to Performance	Model Study	Research Method
				Millar, 1996; Gos, 1996), and Test Anxiety only could have significant effect on Test Performance (for example Hembree, 1988; McDonald, 2001)		
(King, Bond, & Blandford, 2002)	• Computer anxiety	Interaction between class grade and sex showed that females were more likely to be anxious in Grade 7, there was no measurable sex difference in Grade 9, and males had higher level of anxiety in Grade 11. It indicated transition period around Grade 9 and higher which implied that females became a lot less anxious about computer usage than males.	372 students of Grade 7, 314 students of Grade 9, and 224 students of Grade 11 from state and private high school in Australia.	-	-	Survey
(Stricker, Wilder, & Rock, 2004)	• TOEFL Acceptance • Attitude toward computer • Test Anxiety • Computer Familiarity	• Attitude toward computer was found positively correlated with TOEFL acceptance. • Test anxiety negatively correlated with TOEFL acceptance in Cairo and Frankfurt	143 TOEFL test takers in Buenos Aires, 138 in Cairo, and 402 in Frankfurt.		CBT	
(Bodmann & Robinson, 2004)			55 university students were divided into two (2) groups of respectively 28 and 27 students where each group respectively got CBT and PBT.	▪ No score difference between CBT and PBT. ▪ Students who completes PBT took four (4) minutes longer than those completing CBT.	Blended (CBT and PBT)	Experiment
(Schult & Mcintosh, 2004)	• Test Anxiety • Computer Anxiety	1. For computer group, students reported more anxiety for the exam itself rather than for the computer. 2. Traditional group did not indicate any difference in this situation. 3. In both group, students reported a lot less anxiety for computer than for the exam or completing exam on computer.	163 students: 53 males and 110 females.		Blended (CBT and PBT)	Field experiment
(Smith & Caputi, 2007)	▪ Computer anxiety	1. Cognitive Interference Model of Computer Anxiety (CIM-CA) was used as theoretical framework for evaluation of computer anxiety and its effect on performance in CBT, as well as equivalency test (Smith & Caputi, 2007). 2. CIM-CA proposed that the effect of computer anxiety on performance might differ when computer-based task was completed manually, particularly related to cognitive ability. Computer-based operational task refers to assignments designed to assess skills of the test takers which relate to operation and manipulation using computer (Smith & Caputi, 2007).				Review

Author(s) and Year	Aspect of Individual Differences	Result	Subject(s)	Result related to Performance	Model Study	Research Method
(Stowell & Bennett, 2010)	▪ Test Anxiety	Students who experienced high anxiety in class had a lot lower score of Test Anxiety when completing online examination, t (32) = -5,03, p <.001, while students who experienced low anxiety in class, had a lot higher level of Test Anxiety when taking online examination, t (28) = 2,08, p <.05	69 students	Correlation between anxiety and performance in class was compared to the correlation between anxiety and online performance (r = -.29, p = .02, n = 65). The finding showed a significant difference, z = 1,95, p = .03 (one-tailed). Indicating that the correlation between anxiety and performance in exam was stronger in class setting than in online setting.	Online and paper based test	Experiment
(Ortner & Caspers, 2011)	▪ Test Anxiety		70 females and 40 males aged 16-20 years.	Students who had high anxiety score obtained same average result compared to those who had lower anxiety when taking CBT with fixed item model. When taking adaptive test model, test takers with high Test Anxiety obtained lower test score than those who experienced low Test Anxiety. In other words, adaptive test might cause bias which resulted in disadvantage for test takers with high level of Test Anxiety.	CAT	Experiment
(Terzis & Economides, 2011)	• Perceived playfulness • Perceived usefulness • Perceived ease of use • Computer self-efficacy • Social Influence • Facilitating Conditions • Goal expectancy	1. Goal Expectancy was defined by Content. 2. Perceived Ease of Use significantly correlated to Computer Self Efficacy and to Facilitating Conditions. 3. Perceived Usefulness significantly correlated to Content, Goal Expectancy, Social Influence and to Perceived Ease of Use. 4. Perceived Playfulness was explained by perceived Usefulness, Ease of Use, Content and Goal Expectancy. 5. Intention of using CBA significantly correlated to Perceived Playfulness and Perceived Ease of Use. 6. Computer Self Efficacy had correlation to perceived ease of use of computer.	173 university students	-	CBA	
(Piaw Chua, 2012)	Testing Motivation	1. CBT model increased motivation of test takers to complete test 2. The group which used CBT had higher Testing Motivation compared to PBT group.	140 university students: 68 males and 72 females.		Blended (CBT and PBT)	Solomon four-group experimental design
(Terzis, Moridis, & Economides, 2012)	• Big five Personality (Agreeableness, Neuroticism, Extraversion, Conscientiousness, Openness to experience) • CBAAM which included: PP (Perceived	Of 40 hypotheses proposed, 15 were proven to be significant. They were: PP correlated to BI, PU correlated to PP, PEOU correlated to BI, PEOU correlated to PU, PI correlated to BI, GE correlated to PP, SI correlated to PU, A	117 university students: 45 males and 72 females	-	CBA	

Author(s) and Year	Aspect of Individual Differences	Result	Subject(s)	Result related to Performance	Model Study	Research Method
	Playfulness), PU (Perceived Usefulness), PEOU (Perceived Ease of Use), PI (Perceived Importance), GE (Goal Expectancy), SI (Social Influence), BI (behavior Intention)	correlated to PEOU, A correlated to SI, N correlated to PU, N correlated to GE, E correlated to PI, C correlated to PEOU, and O correlated to PI.				
(Boevé et al., 2015)	• Student Performance • Student Acceptance	1. Students who regularly took computer-based exam were more likely to get used to this model. 2. Students concentrated more on the computer-based final exam when the midterm exam had been CBT. 3. 50% of the total sample students preferred PBT, 25% was abstain, and another 25% preferred CBT.	401 university students who were randomly assigned into CBT and PBT for their midterm and final exam.	No performance difference between students who took CBT and PBT.	(CBT and PBT)	Field experiment
(Balogun & Olanrewaju, 2016)	• Computer Self-Efficacy • CBT Anxiety • Self-Efficacy	1. Computer Self-Efficacy significantly predicted CBT anxiety, students with high level of Computer Self-Efficacy experienced less CBT anxiety. 2. There was gender difference in CBT anxiety. Female students had higher level of CBT anxiety than their counterparts.	131 females and 110 male university students.	-	CBT	cross-sectional study.
(Lu et al., 2016)	• Computer Self Efficacy • Training Satisfaction • Test Anxiety	Computer Self-Efficacy had influence on attitude towards Computer Adaptive Test (CAT)		Hong Lu and associates (2016) found that Test Anxiety had significant negative effect on performance in Computer Adaptive Test (CAT)		
(Nikou & Economides, 2016)	• Motivation • Achievement	There was motivation difference before and after in CBT and MBT treatments. There was no motivation difference in PBT.	34 males and 32 female university students.	Test model did not influence performance and motivation difference in men and women.	PBT, CBT, MBT (Mobile-Based testing)	Experiment

RESULTS

Based on the journal articles reviewed, there are some variables related to individual differences. Among all identified individual differences, not all were analyzed. The variable selection was based on their relation with performance, both directly and indirectly. The identified variables are: (1) Test Anxiety, (2) Computer Anxiety, (3) Computer Self-Efficacy, and (4) Testing Motivation.

Test Anxiety

Some experts have made definitions of Test Anxiety. Test Anxiety is defined as a series of phenomena, physiological and behavioral responses following worries when facing a possible failure consequence in examination or other similar evaluation situations (Zeidner, 1998 cited in Lu et al., 2016). Meanwhile, Sieber, O'Neil, & Tobias (1977 cited in Ortner & Caspers, 2011) defined test anxiety as a series of emotional, physiological, and behavioral responses which follow one's anxiety about failure consequence in examination, test, or other forms of evaluation. Hembree (1988 cited inTonidandel et al., 2002) stated that test anxiety is an anxiety happened in a test situation. In this case, test anxiety has two functions, namely, as a trait and as emotional component. It will change across situation in testing.

Test anxiety comprises affective (physiological arousal, emotionality), cognitive (worry), and behavioral (procrastination, avoidance) components, which together can disrupt one's academic achievement (see Hembree, 1988; Zeidner, 1998). Test anxiety refers to a series of emotional, physiological, and behavioral responses which follow one's worries about the consequences of failure in exam, test, or other evaluations (Sieber, O'Neil, & Tobias, 1977). In term of CBT, CBT anxiety is conceptualized as anxiety or tensions, fear, excessive worries, nervous, and physiological arousal happening before and during CBT (Balogun & Olanrewaju, 2016). Meanwhile, concerning the relation of computer anxiety and test anxiety, there found to be no significant statistical correlation between them, proving that both are two different constructs (Shermis & Lombard, 1998).

Among various definitions, there are similar features which explain that anxiety consists of physiological, emotional, and behavioral components following one's worry when taking a test. Meanwhile, the difference is that some definitions explain that anxiety is due to fear of failure, while others state it is due to the testing. In conclusion, test anxiety is a series of emotional, physiological, and behavioral responses following one's anxiety when taking a test.

Based on the articles which have been reviewed, result showed that test anxiety had notable negative impact on performance in Computer Adaptive Test (CAT) (Hong Lu, et al., 2016). Another study found that test anxiety had negative correlation to performance in various testing or evaluation situations Test anxiety also had negative correlation with mathematic score of CBT (Shermis & Lombard, 1998). A research by M. Llabre and associates (1991) indicated a difference in test anxiety between CBT and PBT.

However, another finding of a study by Christine H.L Cin, J Stuart Don, Robert F Conry (1991) showed that there was no significant difference in test anxiety between PBT and CBT group. In addition, another study also concluded there was no remarkable correlation between perceived performance and anxiety (Tonidandel et al., 2002). Meanwhile, according to Schult & McIntosh (2004), anxiety pertaining to the usage of computer could increase the anxiety experience while taking tests, which in turn would lead to more performance disturbance (Schult & McIntosh, 2004).

Students whose anxiety score is high have the same average score with those with lower test anxiety when taking a CBT with fixed item model. When it comes to adaptive model test, however, test takers with high test anxiety obtain lower test score compared to those whose test anxiety is low. In other words, adaptive test can cause bias which results in disadvantage for those with higher test anxiety (Ortner & Caspers, 2011).

Based on those findings above, it is fair to infer that anxiety test is an individual difference that needs further research concerning its relation to the implementation of CBT. Some researches found its negative correlation to performance, while others found no significant correlation. These two controversial sides indicate that test anxiety still needs further investigation.

Computer Anxiety

There are some definitions of computer anxiety. According to (e.g. Levine & Donitsa-Schmidt, 1997; Paus-Davis & Vispoel, 1993; Powers, 1999) cited in (McDonald, 2002), computer anxiety refers to fear when interacting with computer. Other experts defined Computer Anxiety as computer-related fear, from imbalance level to intimidation by computer (Howard, Murphy, & Thomas, 1986 cited in Smith & Caputi, 2007). Meanwhile, (Deane et al., 1995a, 1995b; Henderson, Deane, & Ward, 1995b) defined computer anxiety as a situational-specific trait which is a manifestation of fear due to computer as a stressor. From these definitions, almost all share similarity which stated that there is a fear component when interacting with computer. Some definitions also state about level of fear, such as one definition by Howard, Murphy, and Thomas (1986 cited in Shermis & Lombard, 1998). To conclude, according to some articles, computer anxiety is defined as fear inflicted by interaction of computer.

Some previous studies asserted that some students were found to be more anxious when taking computer-based examination rather than anxious about computer (Schult & Mcintosh, 2004). Another research result, based on the interaction of class grade and sex, showed that females were more likely to get more anxious about computer during grade 7, there was no gender difference in anxiety about computer during grade 9, while during grade 11, males had higher anxiety toward computer. These indicate a period of change between grade 9 and higher in which females get less anxious about the use of computer than males do (King et al., 2002). Another finding illustrated that computer anxiety negatively related to reading score (Shermis & Lombard, 1998). Additionally, another study found that students with high computer anxiety got lower score in Algebra test (Wise et al., 1989).

A review by McDonald (2002) inferred that computer anxiety could have negative effect on test result. Interaction between computer and test takers was considered as a possible source for anxiety (e.g. Gallagher & Millar, 1996; Gos, 1996), and test anxiety alone could have remarkable impact on test performance (e.g. Hembree, 1988; McDonald, 2001).

Based on the reviewed researches, findings on computer anxiety also showed different results. Some studies found no notable impact, while others collected evidence of deleterious effect. Thus, individual differences, particularly computer anxiety, still need to be investigated further in term of the implementation of CBT.

Computer Self Efficacy

Computer Self-Efficacy is defined as individual's perception concerning their ability in using computer for completing tasks (Compeau & Higgins, 1995 cited in Lu et al.,

2016). Meanwhile, Balogun and Olanrewaju (2016) defined Computer Self-Efficacy as students' presumption and individual efficacy to effectively taking, doing, and succeeding in CBT and other computer-related activities. Similarity among those expert opinions is that the definition of computer self-efficacy comprises individual efficacy towards their ability to use computer. On the other hand, the difference in the definition by Balogun and Olanrewaju (2016) is that it talks about effectiveness in using computer. In conclusion, computer self-efficacy is one's confidence of their ability to use computer.

Previous research showed that computer self-efficacy had strong correlation with attitude towards CAT (Lu et al., 2016). Computer self-efficacy also found to have correlation to perceived ease of use of computer (Terzis & Economides, 2011). Other findings are that computer self-efficacy significantly predicted CBT anxiety, students with higher level of computer self-efficacy experienced less CBT anxiety. Based on these findings, we can infer that computer self-efficacy indirectly correlates to performance in CBT. In addition, it also correlates with other variables, such as ease of use of computer, attitude towards CBT, and CBT anxiety.

Testing Motivation

Testing Motivation is defined as a multifaceted objective and belief which guide behavior (Chua, 2008; Framingham, 2011; Parault & Williams, 2009; Wigfield, Guthrie, & McGough, 1996; Wigfield and Guthrie, 1997). Tonidandel et al., (2002) categorized the facets as:

a. Self-efficacy motivation;
b. Intrinsic motivation;
c. Extrinsic motivation;
d. Social motivation.

The essential element of testing motivation is the Achievement Motivation Theory (Pintrich, 1989 cited in Piaw Chua, 2012) which states that the effort of test takers in facing a test is a function of (a) how well the test takers believe they can complete the test, (b) how much effort is necessary to complete the test, (c) how important the test takers perceive the test, and (d) affective reaction of the test takers toward the test, or their belief about why they should complete the test (Pintrich, 1989 cited in Piaw Chua, 2012).

One similarity across studies on testing motivation is that their definitions of it refer to motivation in the process of completing test. Meanwhile, the difference is that they use different dimension. In short, the definition of testing motivation depends on the motivation theory being used.

The result of researches on testing motivation is that CBT model increased test takers' motivation to complete the test. Group who used CBT had higher testing motivation than PBT group (Piaw Chua, 2012). Perceived performance was fully mediated by the correlation between objective test difficulty and motivation (Tonidandel et al., 2002). Meanwhile, according to another finding, test model did not cause differences in performance and motivation in men and women (Nikou & Economides, 2016).

Based on these findings, there seems to be a dearth of researches concerning the direct relation between testing motivation, in term of the implementation of CBT, with performance or concerning the motivation to complete a test itself. From these few studies, the findings were inconclusive. On one hand, testing motivation increased in CBT, but on the other hand, the evidence showed no motivational difference in CBT and PBT. This fact gives space for other researchers to conduct further investigation.

DISCUSSION

The literature review result shows that there are some individual difference factors that influence performance in CBT implementation. Those individual differences are (1) Test Anxiety, (2) Computer Anxiety, (3) Computer Self-Efficacy, and (4) Testing Motivation. The selection of these individual difference aspects are, for two of them, similar to the four variables which Vispoel and colleagues (1994) used in their research (i.e. test anxiety, academic self-concept, computer anxiety, and computer usage) about their relations to test administration method which in this case is administration using computer.

Based on the analysis of those four individual difference aspects, it can be inferred that they have effect on test performance when CBT is implemented. Three of them, i.e. test anxiety, computer anxiety, and testing motivation, have direct effect on test performance. Meanwhile, computer self-efficacy indirectly influences test performance.

From the analysis of the literature, it can be understood that, in term of the research methodology, most of them used experiment, both experiment using particular design and natural field experiment. CBT administration served as the treatment, where researchers observed its effect on predetermined individual difference aspects and also the performance they resulted in. In term of the research subjects, in line with the application of CBT, the subjects consisted of university and school students. University students dominated as the research subject of all literatures being reviewed. It is in accordance with the early development of CBT in which its application rapidly increased among students.

It is also important to note that, aside from individual differences in psychological or personality aspects, there are also a few studies which investigated demographical individual differences, such as age, class grade, and gender. For instance, a research by Shermis and Lombard (1998) inferred that there was no score difference in test anxiety between males and females. Another finding described the interaction between class grade and sex indicating that females in grade 7 were more likely to get anxious, there was no measurable gender difference in grade 9, and males were found to have higher anxiety in grade 11. This pointed out a period of change during grade 9 and higher in which girls became less anxious about the use of computer than boys do (King et al., 2002).

Test anxiety-related findings can be explained if sorted by the year of research. Findings of researches during 1989 to 2016 showed that test anxiety is still worth to investigate in research in term of its relation to test performance. The results also contributed a great deal. It proves that test anxiety is a critical individual difference factor and can still be examined about its relations with CBT implementation. Of 21 articles being reviewed, most of them involved test anxiety as their research variable. Concerning the age of research subject, test anxiety is also relevant to investigate in high school or university students.

Regarding computer anxiety, literatures showed that it occurred to students who were not familiar with computer, although in their research, Christine H.L Cin, J Stuart Don, Robert F Conry (1991) found that computer anxiety did not correlate with computer experience. Meanwhile, in university students, it was proven to have impact when computer-based TOEFL was administered. It showed that computer anxiety negatively correlated with reading score (Shermis & Lombard, 1998)

For testing motivation and computer self-efficacy, both were rarely discussed in some studies. Of 20 reviewed articles, only three involved motivational aspect and two discussed about computer self-efficacy. However, author regards them

as important variables because findings on them are still inconclusive. Some researches indicated correlation, but others stated otherwise.

In general, there are indeed many limitations to this review. Some of them are pertaining to the limited number of articles being reviewed and the fact that it cannot comprehensively accommodate various kinds of subject or ranges of age. Subject of the reviewed researches were dominated by university students. In addition, location is also another important aspect for the implementation of CBT. In Europe and America, it has been already well-developed, while in developing countries, its implementation only began 10 years ago. Author believe that this also needs some attention.

CONCLUSIONS AND SUGGESTIONS

In the implementation of Computer-Based Test (CBT), there are some individual difference factors influencing performance in CBT. Those individual differences are (1) Test Anxiety, (2) Computer Anxiety, (3) Computer Self-Efficacy, and (4) Testing Motivation. According to the review result, it is fair to conclude that the four aspects have effect on test performance when CBT is implemented. Three of them, i.e. test anxiety, computer anxiety, and testing motivation, have direct influence on test performance. Meanwhile, computer self-efficacy indirectly affects test performance.

Recommendation from this article is that it is noteworthy to involve individual difference aspect in researches concerning CBT. The contradicting findings indicate variation in each subject, CBT model, and else when CBT is implemented. In addition to equivalency aspect, individual differences can also be critical component to investigate because they influence performance while completing CBT.

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