

Advantages and Constraints in the Implementation of Computer-based Summative English Tests (CBEST) in Indonesian Vocational High Schools

Isry Laila Syathroh, Bachrudin Musthafa, Pupung Purnawarman

Universitas Pendidikan Indonesia
Bandung, Indonesia
islaisya@yahoo.com

Abstract—This past ten years, some educational institutions in Indonesia have started to conduct language assessment through computers. In 2017, this computer-based test has been implemented in 9,829 vocational schools in Indonesia. While in 2015 and 2016 there were only 379 and 2,100 vocational schools have implemented this test mode. This paper deals with the implementation of Computer-Based English Summative Tests (CBEST) in one vocational school in Bandung, Indonesia. The paper also focuses on the advantages and constrains found during the implementation of CBEST. The data were collected through observation during the implementation of CBEST and interview with teacher and headmaster. The result of this study reveals that the implementation of CBEST has its own benefits and limitations in relation to aspect of economy, implementation and test administration and test design.

Keywords—Computer-Based Test (CBT); Computer Assisted Language Tests (CALT); vocational schools

I. INTRODUCTION

The use of Computer-Based Test (CBT) in language testing has become popular in many Indonesian secondary schools. Since Indonesian government launched Computer-Based National Examination (CBNE) program in 2014, many secondary schools have also started to apply Computer-Based Summative Tests (CBST). These summative tests consist of daily quiz, mid semester test, final examination, and Try Out test.

Since CBT is a new program in many schools in Indonesia, little empirical work has been done in order to examine the impact of technology on the main basic quality concepts in the assessment. Moreover, little studies have been studied to investigate the washback effect of Computer Assisted Language Testing (CALT) on teaching and learning process. This research will fill the gap by examining the advantages and constrains found during implementation of Computer-Based English Summative Tests (CBEST) in one vocational school in Bandung. In relation to teacher and students as the test takers, the focus of this paper is to investigate their perceptions and experiences in preparing for CBEST. While for the head master, the paper focuses on the advantages and constrains during the implementation of CBEST, in the administration and economical perspectives. Due to the purposes

mentioned above, two research questions are posed: what the characteristics of CBEST and what the advantages and constraints found during the implementation of CBEST are. The two research questions will be the basis of investigation in this research.

A. Computer-based Test in Language Assessment

Computer-Based Test (CBT) is also popular with the term Computer Assisted Language Test (CALT). It can be defined as testing procedure in which language performance is assessed using computer. Elaborates three processes included during the implementation of CBT: *generating the test*, *interaction with the candidate*, and *evaluation of responses* [1]. The first process is *generating the test*. This process refers to a process in which the computer selects a number of items from an item bank, randomly or following some selection procedure until a number of items have been collected and for use in the construction of a test. The second procedure is *interaction with the candidate*. Problems may arise during this process. The third procedure relates to *the evaluation of responses*. In this process, all candidates' data which have been taken during the previous process are called up for a final evaluation of the complete response. Suvorov and Hegelheimer develop nine attributes/ characteristics of CBT, namely: directionality, delivery format, media density, target skill, scoring mechanism, stakes, purpose, response type, and task type [2]. Each attribute will be explained below in separated sections.

B. Directionality

The term *directionality* refers to three types of test directions: linear, adaptive and semi adaptive. Computer linear tests administer the same number of test items in the same order to all test takers. In computer adaptive test, each task is selected by the computer based on the test taker's performance on the previous task. Successful task completion results in a more complex question, while incorrect task completion results in an easier next task. Since computer adaptive test has a lot of limitations (like high cost, exposure to test item, issue with algorithm in item selection), computer adaptive test might become the solution. Computer semi-adaptive tests are adaptive at the level of a group of items called test lets [3], or at the level of the whole test where test takers are given a version

of the test that corresponds to their proficiency level as determined by a pretest [4].

C. Delivery Format

Computer Assisted Language Test (CALT) can be divided into two types of delivery format: Computer Based Test (CBT) and Web Based Test (WBT). In CBT, various offline delivery formats are used such as CD, DVD & standalone software applications that can be installed on an individual computer. However, in WBT mode, test takers do their test in an online format. Regarding to this issue, Ockey predict that due to rapid technological advances WBT will gain more popularity and witness further development in the near future [4].

D. Media Density

One of the issues related to the media density used in CBT is the availability of different media formats and the possibility of their integration. CBT can use a single medium like audio for listening test or test-based reading test. However, some other CBT can integrate the use of multimedia within a test, for example: audio, images, videos, animation, graphics, and so on. However, Douglas and Hegelheimer claim that this issue can result complex measurement and poses a threat to test validity [5].

E. Target Skill

Most CBTs are designed for assessing single language skill, for example: reading test, speaking test, listening test or writing test. However, some other CBTs can be designed to assess integrated language skills, for example: listening and speaking test. Integrated skills assessment reflects the complexity of language use contexts [6] and is believed to enhance the authenticity of language tests through interactivity provided by integrated tasks [4], that are typically performance-based [7]. One of example of integrated skill test is the new TOEFL IBT [8].

F. Scoring Mechanism

In CBT, test takers' performance can be evaluated either by human raters or by computers. Computerized scoring of the input can be done by matching exact answers or analyzing test takers' responses. Exact answer matching entails matching test takers' responses with the correct preset responses. This type of scoring is typically used for the evaluation of receptive skills (i.e., reading and listening) and, sometimes, productive skills (e.g., writing) in the form of one word or even short phrase answers provided that the test has a pre-piloted list of acceptable answers, including the ones with common spelling errors [9].

G. Stakes

Like in Paper Based Test (PBT) CBT also can have low, medium and high stakes for test takers. Roever defines low stakes test as a kind of test which gives little influence for test takers, for example practice test, self-study test, etc [10]. Medium stakes test can give medium impact to the test takers, for example: progress test, placement test, etc. While high

stakes test give huge impacts to test takers' lives such as National Examination, certification tests, promotion, etc.

H. Purposes

Test purpose can be defined as test type and decision which is made on the basis of the test performance. There are two types of test purpose: curriculum-related and other, or non-curriculum-related [11]. Curriculum-related tests can be used for the purposes of admission to a program, placement into a specific level of the program, diagnosis of test takers' strengths and weaknesses, assessment of their progress in the program, and their achievement of the program's objectives. While non-curriculum-related tests are used for language proficiency assessment and screening for non-academic purposes, for example: to make decisions regarding employment, immigration, and so on.

I. Response Type

In CBT, there are two types of responses which can be done by test takers [12]. The first response type is selected responses. Selected response assessment involves tasks that require a test taker to choose a correct answer from a list of options, for example: multiple choice tests. And the second response type is constructed responses. In this type, test takers must develop their own answers and produce short or extended linguistic output.

J. Task Type

There are three categories of CBT task types: selective, productive and interactive task type [2]. The examples of selective task types are multiple choice questions, yes/no questions, etc. The examples of productive are written and oral narratives, short answer tasks, and cloze tasks. While the examples of interactive task type are matching, dragging and dropping the answers. All nine attributes elaborated above can be summarized in the table 1.

TABLE I. ATTRIBUTES OF CBT [2]

NO	ATTRIBUTES	CATEGORIES
1	Directionality	Linear, adaptive and semi adaptive test
2	Delivery Format	Computer Based Test (CBT) and Web Based Test (WBT)
3	Media Density	Single medium and multimedia
4	Target Skill	Single language skill and integrated language skills
5	Scoring Mechanism	Human based scoring and computer based scoring
6	Stakes	Low stakes, medium stakes and high stakes
7	Purpose	Curriculum related and non-curriculum related
8	Response Type	Selected response and constructed response
9	Task Type	Selective, productive and interactive tasks

II. METHOD

A. Research Design

This present study employed a qualitative design with case study approach. A case study research is an empirical enquiry

about a contemporary phenomenon or a case set within the real world context especially when the boundaries between phenomenon and context are not clearly evident [13]. Dornyei also adds that a case study is the study of the particularity and complexity of a single case [14]. A case or a phenomenon here is elaborated by Miles and Huberman might be as a program, an institution, an organization, or a community [15].

By employing a case study approach, this research has several advantages: First, as case studies are qualitative in nature, thus they have the advantage of qualitative research. Johnson claims that a case study is primarily naturalistic which relies on the collection of naturally occurring data [16]. In other words, the data of a case study is high in reliability for the naturalness in terms of behavior, environment and all related aspects of the events investigated. According to Yin, a descriptive case study is “allowing an investigation to retain the holistic and meaningful characteristics of real-life events” [13]. Zonabend cited in Tellis states that “case study is done by giving special attention to completeness in observation, reconstruction, and analysis of the cases under study” [17]. A case study researcher focuses on a single entity as it exists in its natural environment [16]. McMillan and Schumacher also state that a descriptive research using a descriptive mode of inquiry simply describes an existing phenomenon by using numbers to characterize individuals or a group [18]. It assesses the nature of existing conditions.

Qualitative research methods are used to examine questions that can best be answered by verbally describing how participants in a study perceive and interpret various aspect of their environment [19]. Qualitative research provides opportunities for researchers to study social phenomena in relation to people’s everyday lives. Through a process of data interpretation, qualitative research provides information about what, why and how a phenomenon in a society happens. This is line with what Denzin & Lincoln say that qualitative research also involves an interpretive, naturalistic approach to the world [20]. Yin also elaborates that employing qualitative method provides researchers with opportunities to represent the views and perspectives of the people/participants in a study [13].

B. Research Site

This research was conducted in a vocational school in Bandung. Since 2016 the school has become one of adopter schools for *Cambridge*. In the process of teaching and learning English, the school combines the 2013 curriculum in combination with several *Cambridge* books, like *Interchange*, etc. The school has already implemented Computer Based English Summative Test (CBEST). This summative test for English is delivered via computers conducted in language laboratory. The result of the test is gained immediately after the test since the scoring system is computerized.

C. Participants

There are several participants involved in this study: an English teacher and the headmaster. The first participant is English teacher. One English teacher (36 years old) is involved in this study. She possesses 12 years of teaching experience. The headmaster was also involved to be interviewed to gain

more comprehensive data. The more detailed data about the participants are displayed in the table 2 as follows.

TABLE II. PROFILES OF PARTICIPANTS

Participant	N	Age	Qualification	Experience
Teacher	1	36 years old	S1 English Education Department	12 years of teaching English
Head master	1	35 years old	S2 Management of Education	6 years of managing school

D. Instrument

The data for this study were collected by doing observation and interview. Best and Kahn say that interview can be used to gather information regarding an individual’s experiences and knowledge; his or her opinions, beliefs, and feelings; and demographic data [21]. It means that interview is one of suitable methods to elicit data related to perceptions, beliefs, knowledge or experiences because interviews allow researchers to explore issues as they emerge in conversation. Interview also provides an opportunity for the participants to express their understanding or ideas in their own words. Burns also adds that in interview, the participants can use their own words rather than using the words or language that has been set out by the research [22].

The type interview done with teacher and head master is semi structured interview. The topic was about the advantages and constrains found during the implementation of Computer-Based English Summative Tests (CBEST) in the school. The aim of using semi structured interview is to give more opportunities for both the researcher and the participants to do two-way communication. The conversation allows the researcher to explore a wide a range of issues as they emerge in the participants talk and to identify new themes and ideas [23].

According to Burns, a semi-structured interview permits greater flexibility and permits a more valid response from the informant’s perception of reality [22]. Dornyei also says that in using semi-structured interview, although there is a set of pre-prepared guiding questions and prompts, the format is open ended and the interviewee is encouraged to elaborate on the issues raised in an exploratory manner [14]. The semi structured interview was based on a common set of questions but each interview followed up issues as they were raised by the teacher and head master so that their answers about advantages and constrains during the implementation of Computer-Based Summative English Tests (CBSET) could be explored in detailed. The interview was audio-taped and transcribed for further analysis.

E. Procedure

The research was conducted in three steps. The first step was observation. The second step was interview with the teacher. The interview was conducted in the teacher office. The second step was interview with the head master which was conducted in the head master of the school

The next process after collecting the data is to analyze it. Burns says that the purpose of analyzing the data is to find

meaning in the data and this is one by systematically arranging and presenting the information [22]. It has to be organized so that comparisons, contrasts, and insights can be made and demonstrated. Specifically, thematic analysis was used in analyzing the data. Boyatzis elaborates thematic analysis as a strategy in qualitative research to analyze information in a systematic way in order to make the data understandable. It organizes and describes the data in detail according to emergent themes [24]. In doing thematic analysis, the researcher used the phases by Braun & Clarke as the guidance. Table 3 below displays the phases of thematic analysis process [25].

TABLE III. PHASES OF THEMATIC ANALYSIS [25]

NO	PHASES	DESCRIPTION
1	Familiarizing with the data	Transcribing data, reading and re-reading the data, noting down initial ideas
2	Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code
3	Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme
4	Reviewing themes	Checking the themes work in relation to the coded extracts (level 1) and the entire data set (level 2), generating a thematic 'map' of the analysis
5	Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and overall story the analysis tells, generating clear definitions and names for each theme
6	Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research questions and literature, producing a scholarly report of the analysis.

The first step in the process of data analysis was organizing the data. This step involved transcribing the data gained from interview with teacher & head master and students' questionnaire. The data then were analyzed and interpreted to identify the links between the data in the interviews and questionnaire. After transcribing and translating the data, the next procedure was labeling the data based on the data sources. The next analytic procedure was repeatedly reading of the text of the transcription of the interview and questionnaire. The next step was coding. Creswell states that coding process is to make sense out of data, divide it into text or image segment, label the segments with codes, examine codes for overlap and redundancy and collapse these codes into broad themes [23]. In this study, coding was intended to identify certain ideas in the data that represented the same meanings. Finally, the data were categorized into the aspects related to advantages and constrains in the implementation of Computer Based English Summative Tests (CBEST).

III. FINDINGS AND DISCUSSION

The elaboration about the result of this study will be based on the two research questions. The first research question is about the advantages of implementing Computer-Based English Summative Test (CBEST). And the second research question is about the constraints found during the implementation of CBEST. The elaboration of the research result will be explained according to the nine attributes of CBT by Suvorov and Hegelheimer [2]: *directionality, delivery format, media density, target skill, scoring mechanism, stakes, purpose, response type, and task type*.

A. CBEST Implementation

The type of test direction in this school is linear direction. It means that the test administers the same number of test items in the same order to all test takers. The format of the test is Computer-Based Tests (CBT). This offline delivery format usually uses CD, DVD and *Cambridge* software application installed on each computer in the language laboratory. This CBT format only uses a single medium, which is audio for listening test and test based reading test. The result of the test is usually evaluated by computers. The scoring mechanism is usually done by matching test takers' responses with the correct preset responses. Since this CBT is done for summative tests, it usually gives medium impact for students. As Roever says that medium stakes test can give medium impact to the test takers, for example: progress test, placement test, etc [10]. Even though summative tests are important, however students can still take remedial tests if the scores of summative test is below the passing grade. Since this is CBT is done as summative tests, so the purpose of the test is related to curriculum. As Carr says that curriculum-related tests can be used for the purposes of admission to a program, placement into a specific level of the program, diagnosis of test takers' strengths and weaknesses, assessment of their progress in the program, and their achievement of the program's objectives [11]. There are two types of test responses which can be done by test takers in the CBT, namely: 1) selected responses (like multiple choice test) and 2) constructed responses (students develop their answers). Both of the responses were used according to the skills which will be evaluated. This CBT can be categorized as selective task type. The examples of selective task types are multiple choice questions, yes/no questions. All elaboration above can be summarized in the table 4 as follows.

TABLE IV. ATTRIBUTES OF CBT

NO	ATTRIBUTES	CATEGORIES
1	Directionality	Linear test
2	Delivery Format	Computer Based Test (CBT)
3	Media Density	Single medium
4	Target Skill	Single language skill
5	Scoring Mechanism	computer based scoring
6	Stakes	medium stakes
7	Purpose	Curriculum related
8	Response Type	Selected response and constructed response
9	Task Type	Selective task type

B. Advantages and Constraints in Implementing Computer-Based English Summative Tests (CBEST)

Based on the result of the interview with English teacher and head master of the school, it was found that the implementation of Computer-Based English Summative Tests (CBEST) has given several advantages as well as its constraints. The elaboration about CBEST and its advantages and constraints will be based on four educational aspects of CBT: aspect of economy, aspect of system implementation, and aspect of test administration and design. Each aspect will be explained in separated sections.

C. Aspect of Economy

Viewed from the economy aspects, the implementation of CBT in the research site is more efficient than Paper Pencil Based Test (PBT). In economic perspectives, the advantages might include several factors: cost-effective of test in long term, reduce paper, scoring mechanism and preparing students for a more global economy. In PBT, the school usually needed a huge amount of paper to print the test booklets, while in CBT less paper is needed. So it can be said that CBT can promote eco-friendly environment. The other advantage is about the scoring system. In CBT, the mechanism of scoring is computerized, so the school does not need to ask and pay teachers for scoring students' tests. Therefore, CBT can reduce the cost of scoring mechanism and teachers can be more focused on preparing teaching materials rather than spending time for checking students' tests. Moreover, as Cater, Rose, Thille and Shaffer claim that students who participate in computer-based instruction and testing may be more prepared to complete in the global economy [26]. They argue that students in the 21st century need to know how to use technology to obtain good jobs, and teaching students to navigate and successfully complete online tests might help prepare them for the future. However, in the short run, the implementation of CALT often cost more than PBT because they are costly to develop and implement. Many schools might not currently have enough computers and some other related facilities, so the cost for providing these items might need big budget. Moreover, the head master says, that the price for buying a set of *Cambridge* assessment test is expensive, approximately IDR 800,000 per-student.

D. Aspect of System Implementation

Viewed from aspect of system implementation, the implementation of CBT might give several advantages. The first advantages are efficient administration. In Paper Based Test (PBT) the school needs to print the test booklets, store it in one room before distributing them to every classroom. The second advantage is accurate data collection. In CBT, data will be more likely accurately collected and easier to store. Also, results and other data can be stored in much less space and it is easier to retrieve. Moreover, responses generally are accurately captures and scored. In PBT however, students often make some marks on the answer sheets which can result in inaccurate scoring. On the other hand, constraints were found during the implementation of CBT. The school actually has three computer laboratories to conduct CBT. Each laboratory consists of 120 computer sets. However, due to the number of

new students, so the computer availability is not enough. Therefore, the school needs to manage the CBT into shifts during the exam weeks.

E. Aspect of Test Administration and Design

Viewed from the aspect of test administration and design, the implementation of CBT might give several advantages. The first advantage is immediate results. In PBT, the result of summative tests usually takes several days to finish. Teachers as test raters often need time to assess the test and to make decision about the tests. However, in CBT immediate viewing of scores on screen is provided in CBT to give test takers the instant feedback. This is in line with Mojarrad et al. that immediate feedback, accurate test result reports and the possibility of printing the basic testing statistics are other advantages of using computer in assessment field that enable test takers take the test at any [27]. The other advantage of CBT is shorter test duration. In PBT, one subject test usually takes 90-120 minutes. However, in CBT test duration can be made shorter to approximately 60 minutes, because students just need to click the answers without blackening the answer sheets like in PBT. The other advantage of CBT is that it is preferred by students. Some students have used computers to play games and some of them might receive the instruction through computers. Some students might prefer CBT since they can customize the assessment based on their personal preference, like colors on the screen, font types, font sizes, and so on. Due to the possibility of customizing the assessment based on personal preferences, some people prefer to take CBT version of the test. For instance, all students have the option to select their own background color and font size preference on computer screen. Although some students may prefer CBT, others may prefer paper and pencil-based test [26,28]. Some test takers prefer paper-based testing process because they are accustomed to taking notes and circling questions and/or answers for later review. However, constraints during the implementation of CBT are also found. One of them is students' anxiety in using computers. Some students who are lack of computer ability might find it threatening in doing a test using computer. Therefore, training for students before the CBT is needed to be conducted so students will be familiar with the computer and will feel comfortable in doing the test.

IV. CONCLUSION

This present research investigates the advantages and constraints found during the implementation of Computer-Based English Summative Tests (CBEST) in one vocational school in Bandung. All findings which have elaborated above lead to the conclusion that the two research questions have been answered. For the first research question, it can be concluded that the implementation of CBEST has been in accordance with the theories, especially regarding to the attributes of CBT. For the second research question, it can be concluded that the implementation of CBEST has its own advantages and constraints, especially in terms of its aspect of economy, aspects of implementation and aspect of test administration and design.

REFERENCES

- [1] J. Noijons, "Testing computer assisted language testing: Towards a checklist for CALT," *CALICO Journal*, volume 12, no.1, 2012.
- [2] R. Suvorov and V. Hegelheimer, *Computer Assisted Language Testing*. In Antony John Kunnan (Eds.) *The Companion to Language Assessment*, 1st Edition., EdsJohn Wiley & Sons, Inc, 2014.
- [3] P. Winke and F. Fei, *Computer-assisted language assessment*. *Encyclopedia of language and education*, 2008, pp. 1442-1453.
- [4] G.J. Ockey, "Developments and challenges in the use of computer-based testing for assessing second language ability," *The Modern Language Journal*, vol. 93, pp. 836-47, 2009.
- [5] D. Douglas and V. Hegelheimer, "Assessing language using computer technology," *Annual Review of Applied Linguistics*, vol. 27, pp. 115-32, 2007.
- [6] C. Chapelle, W. Grabe, and M. Berns, *Communicative language proficiency: Definition and implications for TOEFL 2000*. TOEFL monograph series 10. Princeton, NJ: Educational Testing Service, 2000.
- [7] L. Plakans, "Integrated assessment", 2009. [Online]. Retrieved From: <http://language-testing.info/video/main.html>.
- [8] Y. Sawaki, L.J. Stricker, and A.H. Oranje, "Factor structure of the TOEFL Internet-based test," *Language Testing*, vol. 26, no. 1, pp. 5-30, 2009.
- [9] J.C. Alderson, *Diagnosing foreign language proficiency: The interface between learning and assessment*. London, England: Continuum International Publishing, 2005.
- [10] C. Roever, "Web-based Language Testing," *Language Learning & Technology*, vol. 5, no. 2, pp. 84-94, 2001.
- [11] N. Carr, *The Shallows: What the Internet is Doing to Our Brains*. VW Norton & Company, 2011.
- [12] C.G. Parshall, T. Davey, and P.J. Pashley, *Innovative item types for computerized testing*. In W.J. Van der Linden & C.A.W. Glas (Eds.), *Computerized adaptive testing: Theory and practice* Dordrecht, Netherlands: Kluwer, 2000, pp. 129-148.
- [13] R.K. Yin, *Case study research design and methods*. 2nd edition. Thousand Oaks, California: Sage Publications, 1994.
- [14] Z. Dornyei, *Research methods in applied linguistics: Quantitative, qualitative and mixed methodologies*. Oxford: Oxford University Press, 2009.
- [15] W.L. Miles, and A.M. Huberman, *Qualitative data analysis*. 2 Edition. Thousand Oaks, California: Sage, 1994.
- [16] D.M. Johnson, *Approaches to research in second language learning*. New York: Longman, 1992.
- [17] W. Tellis, "Introduction to case study," 1997. [Online] Retrieved from: <http://www.nove.edu/sss/QR/QR3-2/tellis1.html>.
- [18] J.H. McMillan and S. Schumacher, *Research in education: A conceptual introduction*. New York: Longman, 2001.
- [19] T.K. Crowl, *Fundamentals of education research*. US: Brown and Benchmark Publisher, 1996.
- [20] N.K. Denzin and Y. Lincoln, *Introduction: The discipline and practice of qualitative research*. In Y. Denzin, N.K., & Lincoln (Ed.), *The sage handbook of qualitative research* (2nd ed.). Thousand Oaks, California: Sage Publication, 2005.
- [21] J.W. Best and J.V. Kahn, *Research in education*. 10th edition. Chicago: Pearson, 2006.
- [22] R.B. Burns, *Introduction to research methods* (4th ed.). French Forest: Longman Group Limited, 2000.
- [23] J.W. Creswell, *Research design: qualitative, quantitative and mixed method approach*. 3rd edition. Thousand Oaks, California: Sage, 2009.
- [24] R.E. Boyatzis, *Transforming qualitative information: Thematic analysis and code development*. California: Sage Publication, Inc, 1998.
- [25] V. Braun and V. Clarke, "Using thematic analysis in Psychology," *Qualitative research in Psychology*, vol. 3, no. 2, pp. 77-101, 2006.
- [26] K. Cater, D. Rose, C. Thille and D. Shaffer, *Innovation in the classroom*. Presentation at the Council of Chief State School Officers (CCSSO) National Conference on Student Assessment, 2010.
- [27] H. Mojarrad, F. Hemmati, M. Jafari Gohar and A. Sadeghi, "Computer-based assessment (CBA) vs. Paper/pencil-based assessment (PPBA): An investigation into the performance and attitude of Iranian EFL learners' reading comprehension," *International Journal of Language Learning and Applied Linguistics World*, vol. 4, no. 4, pp. 418-428, 2013.
- [28] M. Russell, R. Hoffman, and J. Higgins, "Meeting the needs of all students: A universal design approach to computer based testing," *Innovate Journal of Online Education*, vol. 5, no. 4, 2009.