A CBT FRAMEWORK FOR SECONDARY SCHOOLS OF SAUDI ARABIA

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*ABSTRACT***:** *In this era of advanced technology, the learning paradigm is shifting from traditional teacher to student model of pedantry to e-learning. There are numerous e-learning environments that use modern technologies in which assessment plays an important role to measure student progress. In this milieu, traditional paper based testing is unsuitable, hence, e-Assessment (Computer Based Testing or CBT) was introduced to overcome archaic limitations and streamline evaluation procedures. E-Learning is growing and has become popular, even common place, in a few sectors of Saudi Arabia's Secondary Schools, for which the Ministry of Higher Education continually strives to improve. But due to a lack of suitable planning and evaluation protocols, limited reviews of these efforts have been recorded. This paper, therefore, proposes a framework that may help improve CBT implementation in Saudi Arabia, specifically at the secondary level. A survey of six schools in Saudi Arabia was made to validate components of the framework. The outcomes suggests that our proposal will appropriately address issues raised by previous attempts at CBT implementation.*

1. INTRODUCTION

The aim of this research is to present a framework for the design of CBT online assessment systems in Saudi Arabia secondary schools and to clearly spell out all factors and parameters that should be considered in design and implementation processes by analyzing current systems and methods of examination in secondary schools in Saudi Arabia. The study also takes a critical look at question types, marking processes, and the ability to automate these tasks to increase efficiency, precision, accurate recording, easy storage, and the modification and retrieval of student exam records. This research provides a complete report on the current examination system and the best automation process to adopt in the design and implementation of a CBT online assessment system.

E-learning refers to the use of computers and electronic devices for educational purposes [22] [6] and is defined as the use of ICT technologies in a learning environment. Government strategies consider e-learning the confidant use of ICT opportunities that comprise the entire pedagogic range, including flexible distance modalities that use ICT to deliver and communicate useful knowledge to groups and individuals, which improve the management of learning in support of student achievement [15]. The advent of multimedia based testing provided a superior solution due to its fast and accurate scoring, feedback streams, and self-paced testing capability. In addition, it reduces test anxiety and cheating while challenging and without frustrating examinees. Furthermore, it offers immediate and continual examinee guidance and provides learning directives that are student-centered and thus, personalized. As such, e-learning and CBT captured the attention of many organizations [5] [19] that then gravitated towards the incorporation of CBT tools (e.g. GRE, GMAT, TOEFL, MCSE) [12].

This is not surprising as traditional paper-based testing consumed time as well as financial and human resources for preparation, printing and grading [10]. It also required enormous archival support and retrieval of past exam papers, in addition to problems associated with tracking and reporting results; not to mention the inaccuracies of marking and recording, or delays in final presentation and issuing of results. All these efforts were compounded when students ask for re-marking and constituted major problems for management.

Presently, most CBT systems, particularly those adopted by Saudi Arabia, make use of the summative assessment approach while the formative component remains underutilized. Hence, there is need to better integrate both methods of assessment for the optimal implementation of CBT. Although many teachers have tried to incorporate features of formative assessment, it is still not practiced systemically. To remedy this deficit, teachers will have to modify learning outcome platforms towards interaction with students and more effective student guidance. Our proposal attempts to address this challenge by providing a framework for readjustments.

2. LITERATURE REVIEW

2.1 Computer Based Testing (CBT)

Before the emergence of "e-learning," terms like "internet-based training" and "web-based training" were used to describe communication technology and distance learning in the field of education. Although these terms are still used, e-learning is now more popular because it focuses more on technological and educational principles that have evolved as a result efforts in numerous educational fields.

Since education is a vital human activity, there is tremendous interest in the development of education techniques and tools. E-learning has been implemented globally by many colleges and schools under the name of Learning Management System (LMS), the software tool most commonly used. LMS includes:

(1) Student Management and Reporting for student groups and administrators in addition to tracking and reporting of students activities.

(2) Learning Event and Resources Management and Reporting: grants the system administrator several

levels of access rights and privileges such as registration and the logical organization of events and courses; thus, providing an interface between student and systems administrator(s).

(3) Online Course Delivery Infrastructure: a module allowing users to set up courses to be taught online. This includes syllabus details and course prerequisites.

(4) Course Authoring Tools: allows users to create new course materials.

(5) Skill/Competency Assessment: helps instructors design individual teaching paths through the provision of analytical capabilities for student assessment.

(6) Professional Development Management: helps track students for future professional development.

(7) Knowledge Bases: an additional tool that helps LMS integration with external academic resources and references in support of online courses.

(8) Learner Centric and Organization Personalization: creates individual profiles for each student and delivers news, targeted courses, references and other data.

Computer Based Assessment (CBA) is a popular and key component of the e-learning environment.

"In their short and approximately 20-year history, modern CBAs have relieved us from P&P or cumbersome apparatus, have lowered the cost of testing in many ways, have allowed us to construct more accurate and elegant versions of tests, and have extended the limits of our assessment potential" [20].

A growing concern in e-learning for researchers and users is quality. Different international standards [4] define good practices, but all practices cannot be reduced because of political issues and a wide variety of local and national professional practices, rules and regulations [23].

2.2 Issues of CBT in Saudi Arabia

Although the use of CBT is presently encouraged due to the widespread use of ICTs, the use of CBT in the context of higher education remains limited [13]. Factors that influence their use include applications developed by international vendors that target higher education environments [8], but due to differences in cultural, social and technological aspects, these applications are limited [21] and require customization according to regional, cultural, and social differences. Another major issue is the difference of equivalence between traditional paper based testing and CBT [14, 17]. Researchers argue that these modes are not equivalent because their characteristics produce different qualitative assessment experiences for each subject, known as the 'test mode effect' [7]. A further challenge is marked irregularity in student capabilities, attitudes, expectations and technological competence [16]. This non-homogeneity results in non-equivalent assessments between students. The most common example is slow typing speed, which causes anxiety among students and affects the assessment process [16]

The Ministry of Higher Education in Saudi Arabia has been implementing e-learning to integrate ICT tools in learning that improve the quality of education. However, many factors negatively influence student behavior and precludes their participation in e-learning environments [3]. For example, Al-Jarf [1] remarks that her e-learning English course's environment was a complete failure. She explains the reasons as a lack of interaction among students; student reticence caused by unfamiliarity with online systems and negative attitudes towards collaboration with students from another university.

Furthermore, a very limited number of faculty members utilize these systems for teaching and learning in Saudi Arabia [2]. The main cause is insufficient ICT skills and a general lack of interest. Nevertheless, due to the large number of students and limited number of capable and qualified faculty members, the National E-Learning and Distance Learning Center (NELC) has initiated several studies to enhance e-learning in Saudi Arabia [2].

3. PROPOSED FRAMEWORK

This section presents our proposed framework for the design of a CBT online assessment system. Figure 1 identifies six pivotal elements involved in the design and delivery of CBT that specifically include planning, analyses, design, development, delivery, and evaluation. This approach is supported by the following studies [9] [11] [18]. Our proposal shows that CBT online assessment systems can be designed and/or adapted to enhance and enrich learning to achieve learning outcomes and implement computer based test assessments online more effectively by adopting the strategies discussed below. Some of these strategies may be replicated for each pivotal element based on how best they fit specific needs of learners and the learning environment. The learning strategy determines the best learning approach and delivery method for each learning activity. These include:

- Details of each sample (source, course to be used, customizing options, etc)
- Guides as to when best to adopt a given strategy
- Step-by-step instructions, required skills and tools.

Fig. 1. Proposed CBT Online Assessment System Framework

3.1 Plan: Assessment Action Plan

The action plan is the management overview the program's assessment. It outlines the scope of assessment, what staff and resources are available, what skills are needed, and what support is provided for learners. The aim is to use this plan to demonstrate and record the organisation's commitment to quality assessment. Figure 2 shows the assessment's 'action plan' framework.

3.2 Analyze: Assessment Design Brief

The 'Assessment Design Brief' summarizes research findings regarding the learners' context, successful organizational practices, and useful assessment materials. It is a prototype and will likely present challenges. Figure 3 presents the framework.

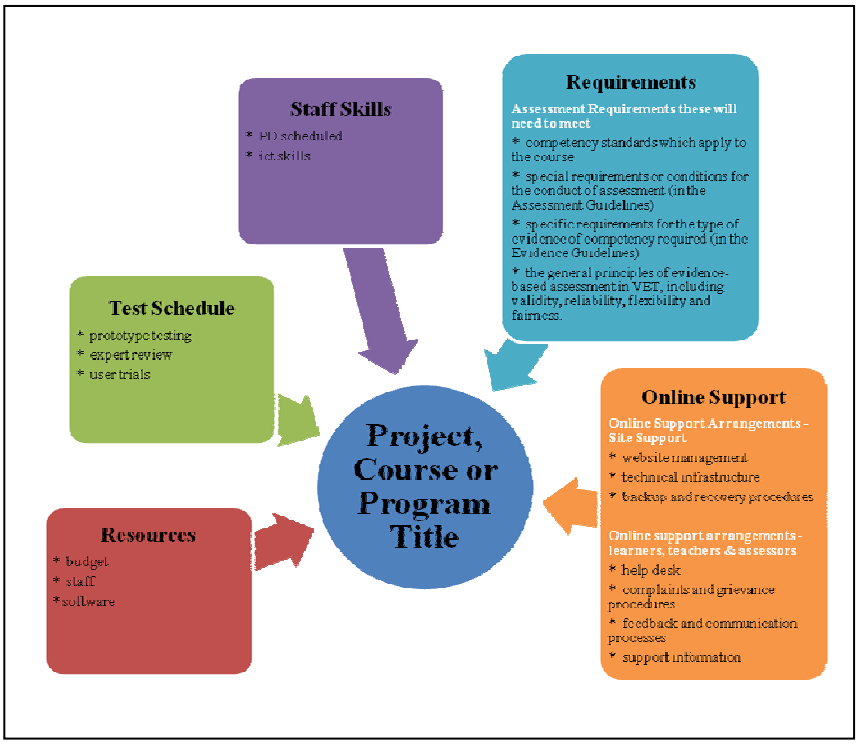

Fig. 2. Framework of the Assessment Action Plan

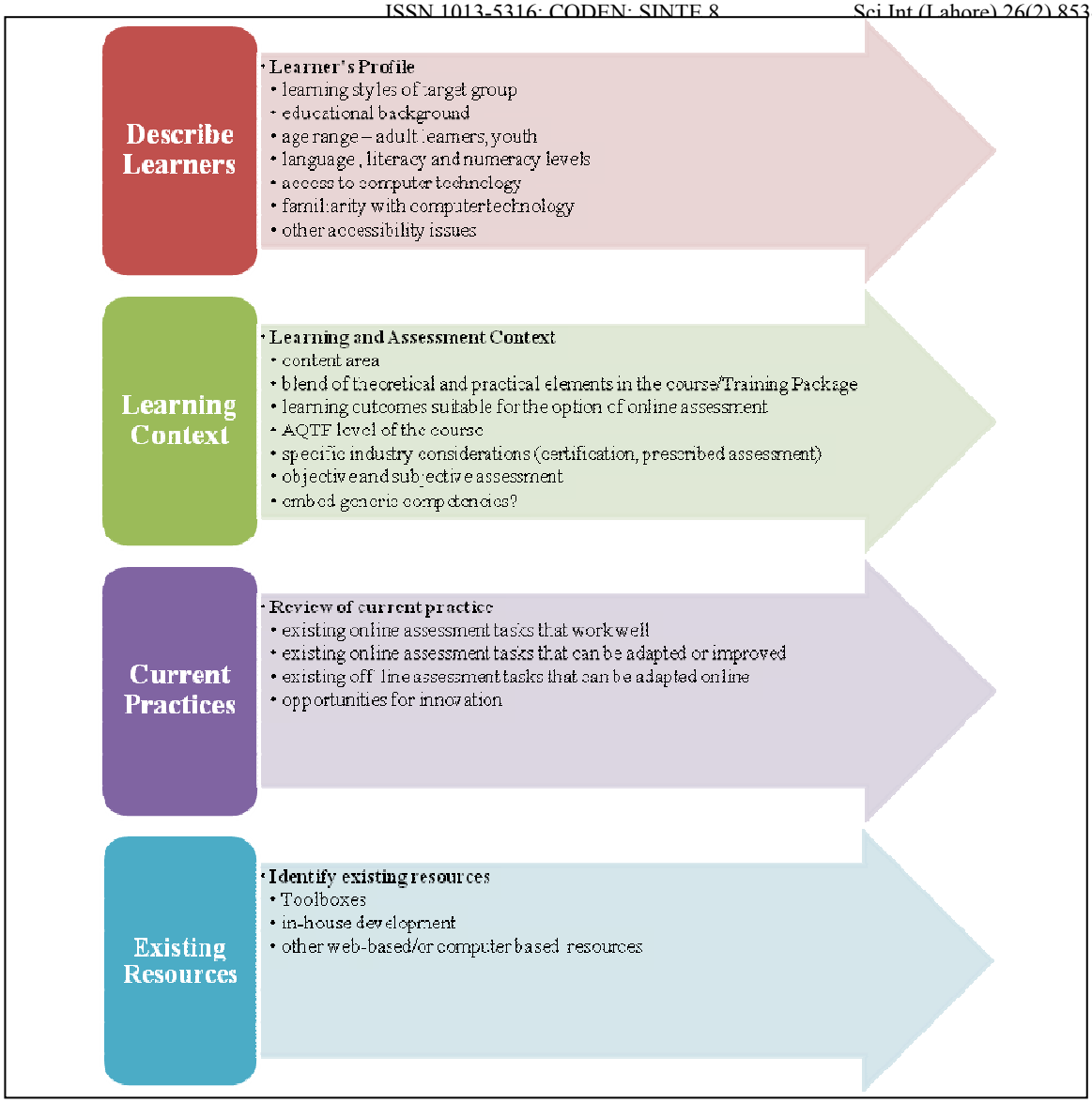

Fig. 3. Framework of the Assessment Design Brief

3.3 Design: Assessment Design

The design presents solutions for providing relevant and effective student assessment. It describes approaches, strategies, and rationale. Figure 4 illustrates the framework.

Develop: Assessment Development Record

The development record documents the process of preparing and testing assessment tasks and support materials as shown in Figure 5.

Deliver: Assessment Conduct Report

The report records what happens when the assessment is conducted and provides information for the evaluation of assessment materials and processes. The Framework is presented in Figure 6.

Evaluate: Assessment Review

The assessment review describes how and why the approach, materials and/or process may be modified. The framework is presented in Figure 7.

4. EVALUATION, RESULTS AND DISCUSSION

For purposes of our evaluation, schools were carefully selected from different secondary schools in six different regions of Saudi Arabia, namely: Manamel Aljameah Private Girls Secondary School (MAPGSS), Almathaya Government Girls Secondary School (AGGSS), Almaerefah Private Boys Secondary School (APBSS), Alahad Government Boys Secondary School (AGBSS), Abu Arish Government Boys Secondary School (AAGBSS), and Moaath Bin Jabal Government Boys Secondary School (MBJGBSS). Results from each phase of the survey are discussed in detail below.

Assessment Action Plan

This first section looks at the action plan for management overview. Here, we outline the scope of assessment, the staff, skill and resources required, and the type of support students need. In response to the first question: "To what extent do you agree on the assessment requirements for CBT?" four key assessment requirements were identified (Table 1).

Fig. 4. Framework of the Assessment Design

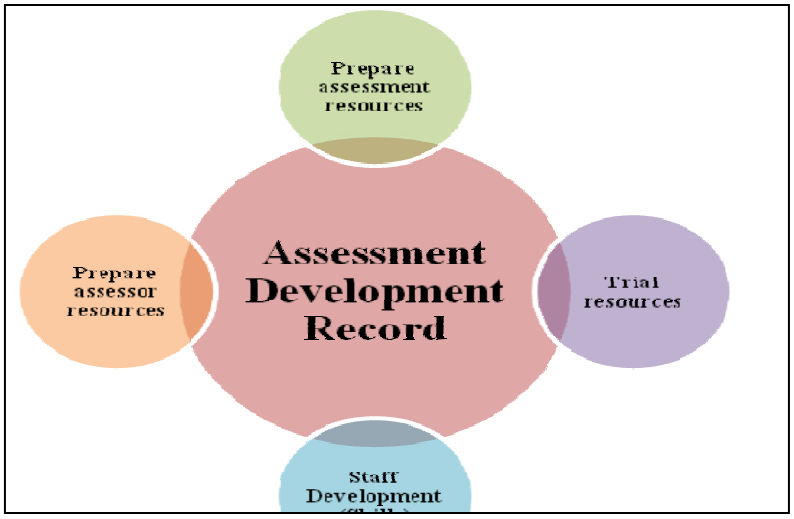

Fig. 5. Framework for Assessment Development Record

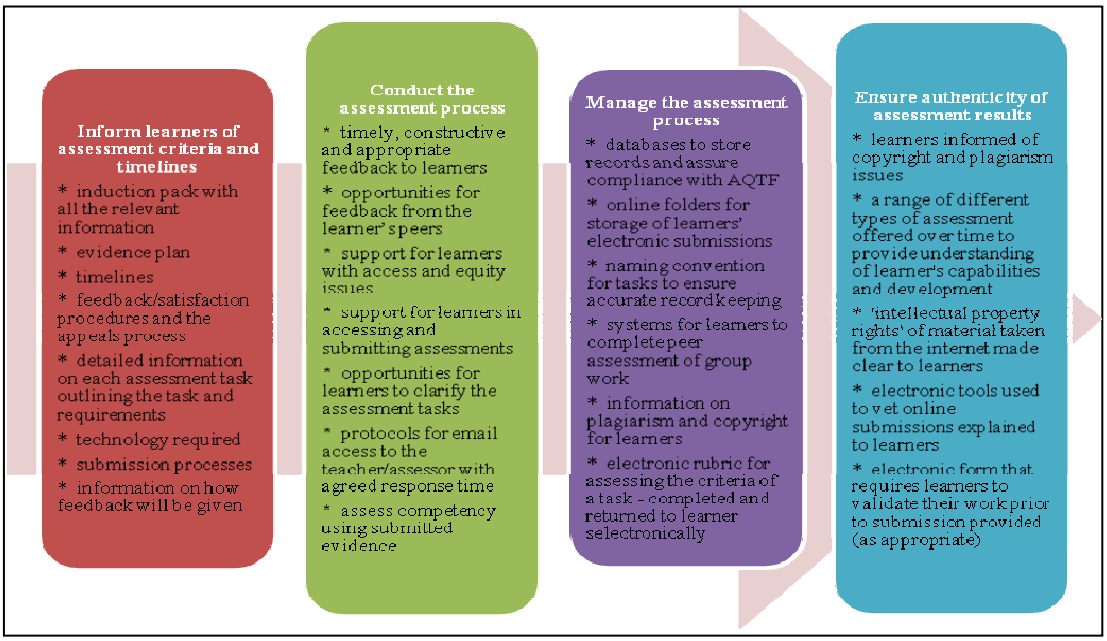

Fig. 6. Framework for Assessment Conduct Report

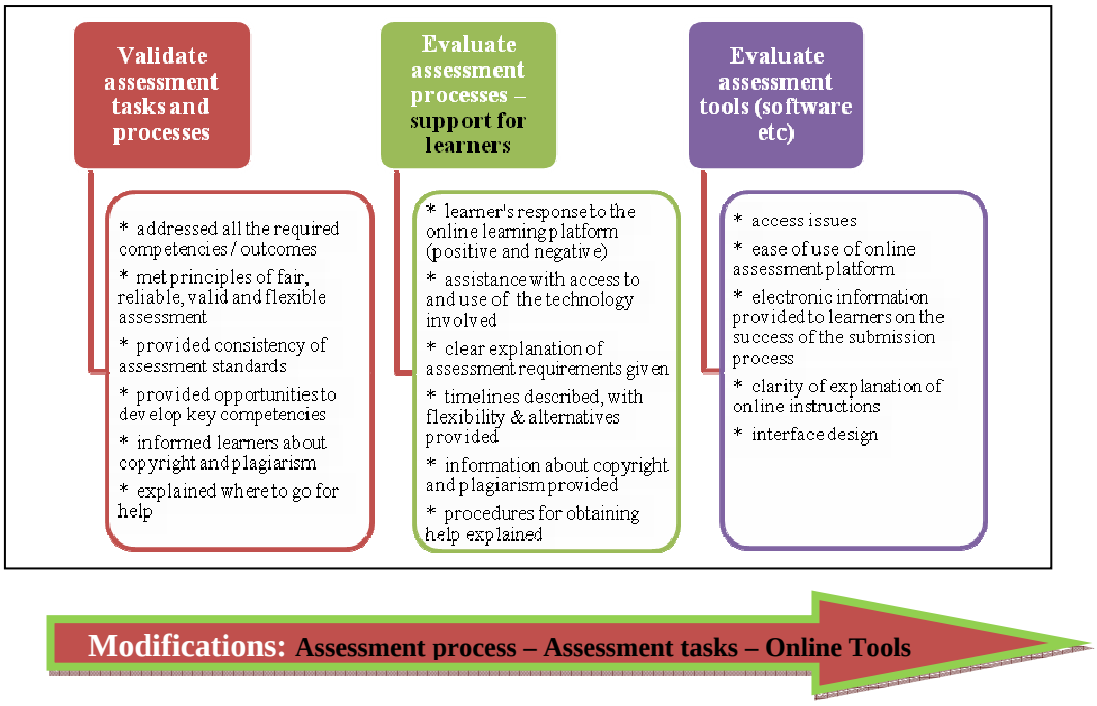

Fig. 7. Framework for Assessment Review

4.1

Table 2 shows that 100% of our participants strongly agreed that website management, technical infrastructure, and Participants from all six schools strongly believed that competency standards as applied to the course should form part of assessment requirements. They all also strongly agreed on the following needs when applying CBT assessments: special requirements for the conduct of assessment (Assessment Guidelines); specific requirements for the conduct of assessment (Evidence Guides); and general principles of evidence-based assessment in VET (including validity, reliability, flexibility and fairness).
backup and recovery procedures were important online support arrangements for CBT systems.

Table 1. Assessment requirements for CBT agreed by school

Schools / Assessment Requirements	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
Competency Standards	√	√	√	√	√	√	**6**
Assessment Guidelines	√	√	√	√	√	√	**6**
Evidence Guides	√	√	√	√	√	√	**6**
Principles of Evidence Guides	√	√	√	√	√	√	**6**
No. of Requirements	**4**	**4**	**4**	**4**	**4**	**4**	

Table 2. Online Support Arrangements for CBT, as agreed by all six schools

Schools / Learners Online Support Arrangements	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
Help Desk	√	√	√	√	√	√	**6**
Complaints and Grievance Procedures	√	√	√	√	√	√	**6**
Feedback and Communication Processes	√	√	√	√	√	√	**6**
Support Information	√	√	√	√	√	√	**6**
No. of Requirements	**4**	**4**	**4**	**4**	**4**	**4**	

Table 3. Online Support Arrangements that are necessary for learners

Schools / Online Support Arrangements	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
Website Management	√	√	√	√	√	√	**6**
Technical Infrastructure	√	√	√	√	√	√	**6**
Backup and Recovery Procedures	√	√	√	√	√	√	**6**
No. of Arrangements	**3**	**3**	**3**	**3**	**3**	**3**	

All participants strongly agreed that help desk services, complaints and grievance procedures, feedback and communication processes, and support information should be made available to learners. Thus, we may conclude that Competency Standards, Assessment Guidelines, Evidence Guides, and Principles for Evidence Guides are key assessment requirements for CBT online assessment. From Table 4.2, we also determined that a CBT online assessment system requires online support arrangements as follows: Website Management, Technical Infrastructure, and Backup

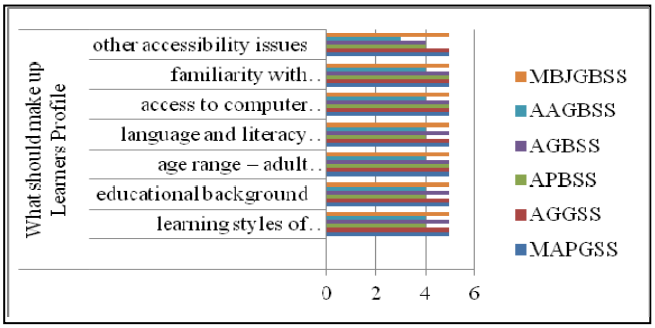

Fig. 8. Framework for Assessment Review

and Recovery Procedures. From the analysis presented in Table 4.3, we see that a Help Desk should include Complaints and Grievance Procedures, Feedback and Communication Processes, and Support Information for the provision of online support arrangements for students enrolled in a CBT online assessment system. Hence, in order to determine the scope of assessment, as well as staff, resources, skills, and support required for CBT online assessment systems, an assessment action plan that includes the above cited parameters and measures should be employed (Figure 9).

4.2 Analysis or Assessment Design Brief

Here, we analyzed the contextual student milieu with regard the successful practices that may be adopted and applied, including assessment materials from other sources.

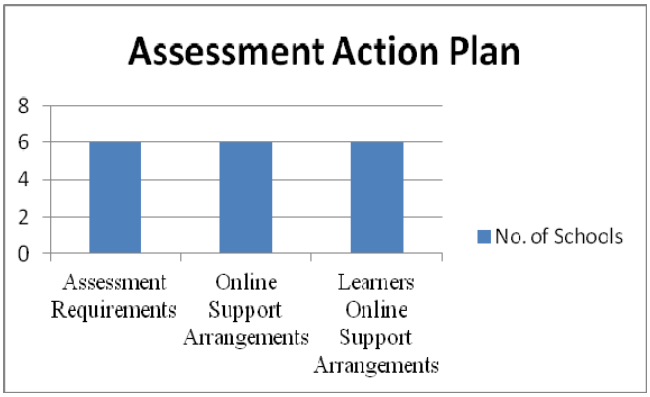

Fig. 9. Learners Profile

The aim was to identify available resources and assessment challenges.

Figure 8 seventy-five percent of participants strongly believed that learning styles of the targeted group, their educational background, age range, language and literacy levels, access to computer technology, familiarity with computer technology, and other accessibility issues should comprise the learner's profile, whereas, 25% did not think that these factors were important.

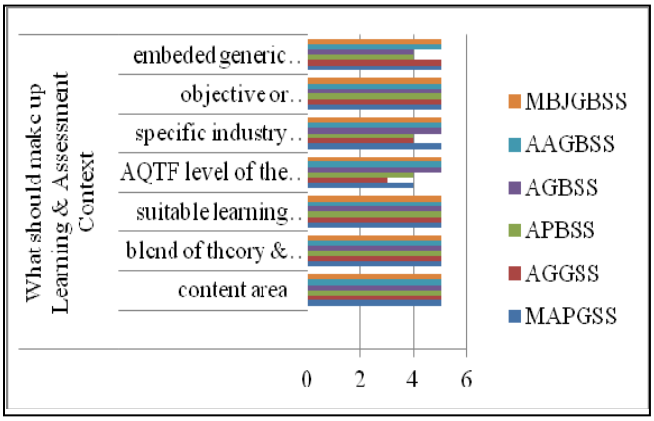

Fig.10. Learning and Assessment Context

Table 4 shows that five of six participating schools strongly agreed that existing online assessment tasks worked well and should be considered when reviewing current practices. All schools agreed that existing online assessment tasks can be improved or adapted, and that existing offline assessment tasks can also be adapted online, and that opportunities for innovation should be considered during current practices reviews.

From our analysis of the data presented in Figures 2 and 3, and Table 4, we concluded the following: (i) that an assessment design brief should clearly indicate learners' characteristic profiles and needs in context; in addition to (ii) successful practices that can be applied or adapted; and (iii) what assessment materials are adaptable and useful.

4.3 Assessment Design

This section discusses both approach and strategies that provide effective learner assessments and why they are important.

Table 5 reveals that two out of six participating schools considered constructivist assessment important while another two considered 'criterion referenced' as such. Four of the six regarded formative assessment important and another four of six believed summative assessment (competence) was important. None considered the following for assessment approaches: problem based learning, entry level skills, formal recognition of prior learning, and self-assessment. Thus, we may conclude that formative and summative assessments are more important approaches for the CBT online venue. Figure 12 summarizes these approaches.

Figure 10 above over 85% of participants strongly agreed on seven factors that should compose the Learning and Assessment Context, namely: content area, blend of theoretical and practical elements, learning outcomes suitable for online assessment, ATQF level of the course, specific industry considerations, objective or subjective assessment, and embedded generic competencies. These results demonstrate that these factors are crucial.

Table 4. Review of Current Practices

Schools	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	**No. of Schools**
What to Consider When Reviewing Current Practices							
Existing Online Assessment Tasks Working Well	√		√	√	√	√	**6**
Existing Online Assessment Tasks that can be Improved or Adapted	√	√	√	√	√	√	**6**
Existing Offline Assessment Tasks that can be Adapted to Online	√	√	√	√	√	√	**6**
Opportunities for Innovation	√	√	√	√	√	√	**6**
No. of Requirements	**4**	**3**	**4**	**4**	**4**	**4**	

Table 5 shows that four of the six schools believed that adopting at least two approaches was ideal, while one school believed a minimum of three assessment approaches was ideal, and another school considered only one assessment approach ideal. Hence, we conclude that a *minimum* of two out of eight approaches should be considered in a CBT online assessment system. These may be chosen from any of the following four (constructivism, criterion referenced, formative assessment, and summative assessment). A summary is presented in Figure 13.

Table 6 shows that all participating schools agreed on the listed strategies as collaborative, individual and workplace tasks with the exception of 'courseware' tasks where four of the six schools agreed that all strategies should be used, while two of the six chose five and four strategies out of the seven for courseware tasks, respectively. We may conclude that all listed strategies should be incorporated as collaborative, courseware, individual and workplace tasks in a CBT online assessment system.

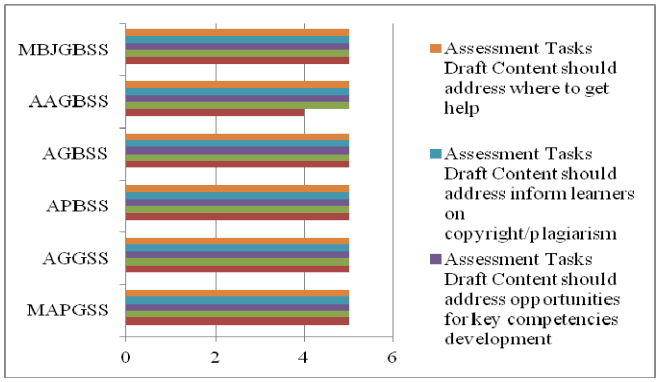

Fig. 11. What Draft Content Used for Assessment Tasks Should Address

Table 5. Important Assessment Approaches

Schools / Assessment Approaches	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
constructivism			√	√			**2**
Criterion referenced	√				√		**2**
problem based learning							**0**
entry level skills (diagnostic)							**0**
Formal Recognition of Prior Learning (RPL)							**0**
self-assessment (progress check for learner)							**0**
formative assessment (progress check for trainer)	√	√	√			√	**4**
summative assessment (competence)	√			√	√	√	**4**
No. of Requirements	**3**	**1**	**2**	**2**	**2**	**2**	

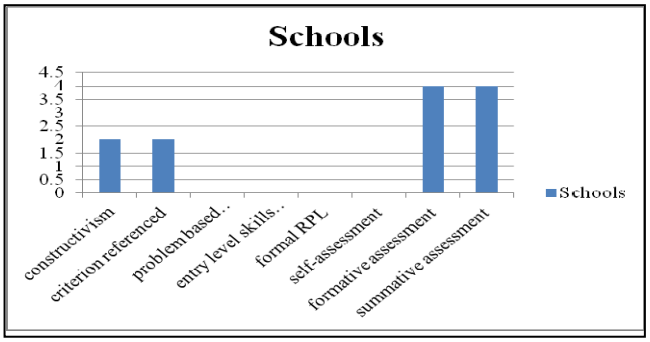

Fig. 12. Assessment Approaches as considered by the Canvassed Schools

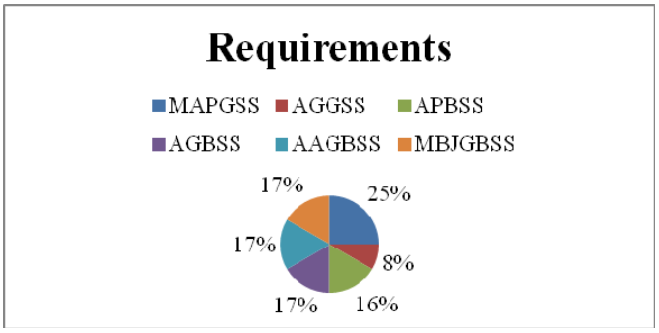

Fig. 13. Number of Assessment Approaches required by school

Table 6. What Strategies should be used for the following tasks

Schools / Collaborative tasks	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
assignment	√	√	√	√	√	√	**6**
team project	√	√	√	√	√	√	**6**
group/peer	√	√	√	√	√	√	**6**
role play	√	√	√	√	√	√	**6**
online discussion	√	√	√	√	√	√	**6**
online chat	√	√	√	√	√	√	**6**
webquest	√	√	√	√	√	√	**6**
Courseware tasks							
Multiple Choice	√	√	√	√	√	√	**6**
Crossword	√	√	√	√	√	√	**6**
Cloze	√	√	√		√	√	**5**
Drill & Practice	√		√	√	√	√	**5**
Simulation	√	√	√	√	√	√	**6**
Game	√		√		√	√	**4**
webquest	√	√	√		√	√	**5**
Individual tasks							
Worksheet	√	√	√	√	√	√	**6**
Journal	√	√	√	√	√	√	**6**
Report	√	√	√	√	√	√	**6**
Scenario	√	√	√	√	√	√	**6**
Research	√	√	√	√	√	√	**6**
Workplace tasks							
Testimony	√	√	√	√	√	√	**6**
Video	√	√	√	√	√	√	**6**
Assessor	√	√	√	√	√	√	**6**

Figure 11 above shows that all the participating schools strongly believe that the draft content for resources used for assessment tasks should address all required competencies/outcomes; meet the principles of fair, reliable, valid and flexible assessment; provide opportunities to develop key competencies; inform learners about copyright and plagiarism; and explain where learners can go for help. Hence, all cite issues should be addressed by the draft content for resources used for assessment tasks in a CBT online assessment system.

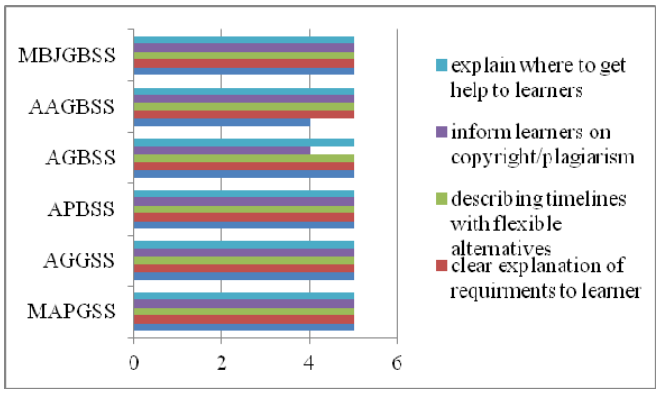

Fig. 14. Resources that assist to support learner

Figure 14 shows that all the six participating schools strongly agreed to assist learners to access and use the technology, explain requirements clearly, inform learners about copyright and plagiarism, explain where learners can get help, describe timelines and provide flexibility and alternatives. We therefore concluded these are necessary resources that support learners in a CBT online assessment system.

In summary, our assessment design presents clear solutions that provide a relevant and effective approach to assessing the learner within this system. They further describe and validate a clear strategy that identifies what types of approaches to use and what methods to adopt to accomplish tasks in hand, as well as which resources best address the assessment challenge and support learners.

4.4 Assessment Development Record

This section cites the documentation processes involved in preparation and testing of assessment tasks with support materials.

Table 7. What should be considered by teachers when preparing assessment resources

Schools / Things To Consider	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
Content	√	√	√	√	√	√	**6**
Instructional Design	√	√	√	√	√	√	**6**
Technical Specifications	√	√	√	√	√	√	**6**
Check Functionality of Uploaded Tasks	√	√	√	√	√	√	**6**
No. of Requirements	**4**	**4**	**4**	**4**	**4**	**4**	

Table 7 shows that all participating schools agreed that content, instructional design, technical specifications, and checks for functionality of uploaded tasks should be taken by teachers when preparing assessment resources. Hence, we concluded these tasks are important components when teachers prepare assessment resources for a CBT online assessment system.

Table 8. What to consider when assessor resources are prepared

Schools / Things To Consider	MAPGSS	AGGSS	APBSS	AGBSS	AAGBSS	MBJGBSS	No. of Schools
Assessment tasks delivery guide	√	√	√	√	√	√	**6**
Strategy overview for successful completion of tasks by online learners	√	√	√	√	√	√	**6**
Checklists	√	√	√	√	√	√	**6**
Rubrics for marking and scoring	√	√	√	√	√	√	**6**
System for assessing group work	√	√	√	√		√	**5**
System for result recording on LMS	√	√	√	√	√	√	**6**
Hints for resolving issues faced by online learners	√	√	√	√	√	√	**6**

All the six schools also agreed that the cited items (Table 8) should be considered necessary when preparing assessor resources in a CBT online assessment system.

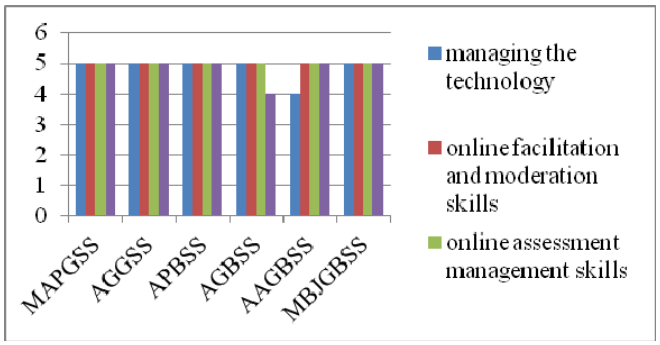

Fig. 15. Necessary skills staff should possess

skills, online assessment management skills, and be able to contribute to online delivery and assessor networks. We concluded, therefore, that it is necessary for staff to possess all of the skills just cited to implement a CBT online assessment system.(Figure 15)

As these are all crucial for success, teachers must consider the issues of content, instructional design, technical specifications and functionality of all uploaded materials when preparing assessment resources. Secondly, a guide for the delivery of assessment tasks with a strategically designed overview for successful completion of tasks by online learners must be developed. The latter portfolio of assessor resources ideally contains checklists, rubrics for marking and scoring, systems for assessing group work, a system for recording results on learning management systems, and hints

on handling common issues faced by online learners. Lastly, it is necessary for staff to have the following skills: managing the technology of LMSSAS for online facilitation and moderation, assessment management skills and the ability to contribute to the online delivery of assessor networks.

4.5 Assessment Conduct Report

Feedback on conducted assessments provide data for the evaluation of assessment materials and processes. We found that all the six schools agreed on select parameters that meet student needs within the leaner's context. These are considered not only valid, but also necessary, and were grouped into four categories as presented in Table 9.

Table 9. How staff should meet the learners' needs and the training context under the following

Inform learners of assessment criteria and timelines	
1	induction pack with all relevant information
2	evidence plan
3	Timelines
4	feedback/satisfaction procedures and the appeals process
5	detailed information of each assessment task outlining the task and requirements
6	technology required
7	submission processes
8	information on how feedback will be given
Conduction of the assessment process	
1	timely, constructive and appropriate feedback to learners
2	opportunities for feedback from learner's peers
3	Support for learners with access and equity issues
4	support for learners in accessing and submitting assessments
5	opportunities for learners to clarify assessment tasks
6	protocols for email access to teacher/ assessor with an agreed response time
7	assess competency using the evidence submitted
Manage the assessment process	
1	databases that store records in compliance with AQTF
2	online folders that store learners' electronic submissions
3	naming conventions for tasks to ensure accurate record keeping
4	systems for learners to complete peer assessment of group work
5	information on plagiarism and copyright for learners
6	Electronic rubrics for assessing the criteria of a task – filled in and returned to the learner electronically
Ensure authenticity of assessment results	
1	learners informed of copyright and plagiarism issues
2	a range of different assessment types offered over time that better provide an understanding of the learner's capabilities and development
3	'intellectual property rights' of material taken from the internet made clear to learners
4	electronic tools used to vet online submissions explained to learners
5	electronic form that requires learners to validate their work prior to submission (as appropriate)

4.6 Assessment Review: Evaluation

This section describes the 'how and why' assessment approaches, materials and processes are modified. Our analysis of the data in Figure 16 determined that all six participating schools agreed that the validation of assessment tasks and processes in CBT online assessment systems requires competencies and outcomes assessment. Secondly, principles regarding fair, reliable, valid and flexible assessments must also be met. Thirdly, consistency of assessment standards is of paramount importance. Fourthly, opportunities to develop key competencies should be provided. And finally, learners must be informed of copyright and plagiarism and how and where to get help.

Furthermore, Figure 17 (below) further highlights the validation assessment processes with regards to support for learners. All six schools agreed that (i) learners' responses to the online platform (positive and negative), (ii) assistance with access and use of technology, (iii) clear explanation of assessment requirements, (iv) timelines described with flexibility and alternatives, (v) information regarding copyright and plagiarism, (vi) and procedures for obtaining help, are criteria that validate the assessment processes and provide support for learners.

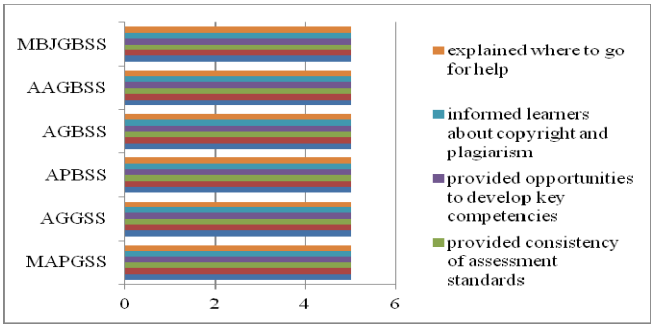

Fig. 16. Criteria for the validation of assessment tasks and processes

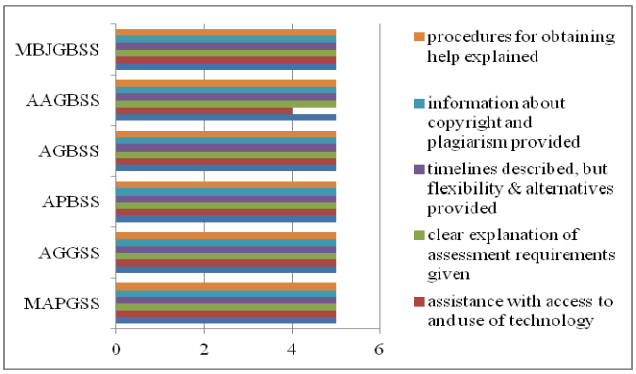

Fig. 17. Criteria for the validation of assessment processes (support for learner)

Lastly, all six schools agreed that the below listed assessment tools (software, etc) should also be validated for any CBT online assessment system. This includes: access issues, ease of use for online assessment platforms, electronic confirmation provided to learners for successful submissions, clear explanations (online instructions), and simplified interface designs (Figure 18).

We therefore recommend that CBT online assessment systems be evaluated and/or assessed according to these specific guidelines (as cited above) regarding the materials or process modifications adopted.

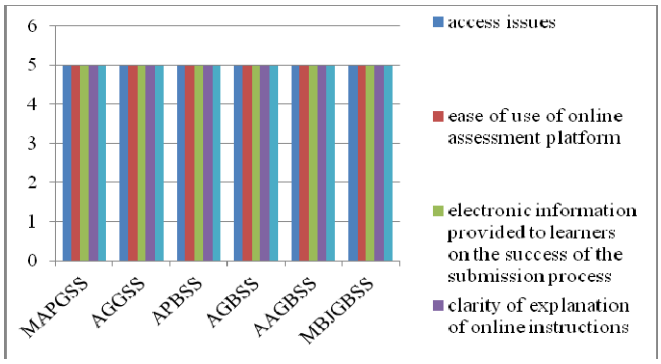

Fig. 18. What assessment tools should be validated

5. CONCLUSION

E-learning has become an extremely popular venue for teaching and learning. Every e-learning system also requires assessment protocols, hence, Computer Based Testing (CBT) is presented for its numerous features and benefits as discussed above. The Saudi Arabian government is integrating e-learning and e-assessment within its educational system, especially in secondary schools, but due to a lack of an optimally informed approach to planning and evaluation, the system has enjoyed limited success. In this paper, we proposed a framework for the implementation of CBT in secondary schools, directly derived from Saudi educators and students. Our results demonstrates a framework that will likely overcome the limitations just cited. Future works include real time implementation of the framework in the Kingdom's secondary schools.

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