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Future Assessment in Higher Education: Reframing Conventional Practices

Ramlee B. Mustapha*

Sultan Idris Education University, 35900 Tanjong Malim, Perak, Malaysia

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*Corresponding Author
Ramlee B. Mustapha
E-mail: dr.ramlee@ftv.upsi.edu.my*

ABSTRACT

The role of universities in the era of the Fourth Industrial Revolution is changing. New demands associated with living in a highly-technological and globally-competitive world require today's students to develop non-conventional sets of competencies. In the 21st century, universities are expected to have digital-savvy students. Hence, digital technology is being used to transform assessment and to provide feedback for students' work. As such, the use of technology-enhanced assessment (TEA) is expected to increase. This article discusses the critical issues of assessment in higher education from varied perspectives. This review signifies critical synthesis of assessment corpus and envisages futuristic world of assessment. The intent is to provide practitioners with tangible alternatives to conventional assessment systems so that they are able to engage and produce more responsive learners. In the old paradigm, assessment in the classroom tends to collect cognitive data – both formative and summative – to provide an indicator of each student's achievement. In the future, digital technology could be used to individualize assessment for each student based on his or her own relevant learning trajectories. Thus, it is critical to rethink the concept of educational assessment in higher education.

Introduction

Globalization has shaped the landscape of higher education for the past several decades. Contemporary scholars have put forward critical analyses on the impact of globalization on higher education (see for example, Altbach, 2004, 2007; 2009; 2010; Barnett & Baker, 2012; Carnoy & Rhoten, 2002; Etzkowitz, 2004; Etzkowitz et al., 1997; 1998; 2000; Giridharan & Ling, 2019; Mustapha, 2013; Nisar, 2015; Sample, 2002; Teichler, 2004; Temple, 2012). In the 21st century, an academic revolution has taken place in higher education institutions marked by transformations unprecedented in their mission, roles and scope (Altbach et al., 2009). Even at the gradual level, evolution has accelerated from geologic speed to internet speed that could make artificial intelligence at par with human intelligence (Church, 2012). Hence, new demands associated with living in a highly-technological and globally-competitive world require today's students to develop a very different set of competencies than the previous generation. In the light of the technological innovation in higher education, the assessment systems may also need to be reconceptualized to suit the new demands. This article reviews the key initiatives in improving assessment in higher education. The importance of assessment is undeniable due to its impact on an individual's future life and career. Race, Brown and Smith (2005: xi) highlighted this point:

> Nothing that we do to, or for, our students is more important than our assessment of their work and the feedback we give them on it. The results of our assessment

influence our students for the rest of their lives and careers – fine if we get it right, but unthinkable if we get it wrong.

Hence, the risks of assessment are evident. In general, most assessment experts agree that a single test should not be used to evaluate an individual's learning – the consensus holds concerning the need for multiple assessment instruments to be used to provide more accurate evaluation. According to Wilson and Scalise (2006), a single summative score in the form of a grade can do little to inform the mastery of a complex competency. Based on literature and discussions to understand the major challenges for assessment, the lack of trust in the system between teaching professionals and assessment experts is one of the cruxes of the problem (Bassett, 2015). In higher education, the challenge now facing the neo-pragmatic post-modern test theory is to devise assessments that, in various ways, incorporate and balance the strengths of formal and informal assessments by capitalizing on an array of conceptual, methodological, and technological deliberations (The Gordon Commission, 2013). Therefore, it is essential to reconceptualize assessment as an important part of learning systems designed to suggest relevant personalized learning. In the context of higher education, assessment is designed to inform and improve teaching and learning processes and outcomes, without ignoring the importance of accountability (The Gordon Commission, 2013). According to Shute et al. (2009), approximately 10% of the class time is spent on assessment. New requisites associated with living in a cyber-intensive world require today's students to possess an innovative mindset with new competencies especially digital capabilities. Disruptive technology and innovation have had a high impact on the existing assessment systems in higher education.

The future assessment in higher education could be influenced by research outputs and technological advancement (The Gordon Commission, 2013). A term such as technology-enhanced assessment (TEA) was coined to describe the shifting models of learning and educational assessment to adopt technological changes in higher education (Mogey, 2011; Oldfield et al., 2012; Timmis et al., 2016; Whitelock & Watt, 2008). However, the reluctance to change could be due to a number of factors: the multi-layered changes that assessment requires, restrictions within the assessment system, and an aversion to the risks that an assessment transformation would inevitably bring (Perrotta & Wright, 2010; Timmis et al., 2016; Whitelock & Watt, 2008). In addition, little research has been conducted to understand how technology-enhanced assessment could assist to shape and drive

wider changes in assessment. According to Timmis et al. (2016), with the potential to increase personalization, self-regulation and peer involvement in learning, as well as to offer the opportunity to evaluate complex skills and practices, digital tool is a useful catalyst for the reframing of assessment in higher education.

Higher education is also critical to contemporary knowledge economy. Knowledge economy is basically driven by innovation (Asian Development Bank, 2014; Mustapha, 2013; 2017; Powell & Snellman, 2004). New ideas on pedagogies and assessment in higher education are based on robust R&D. E-learning and online assessment are products of ivory tower research that are being implemented in most universities. However, the accuracy and quality of assessment in universities are questionable due to the relatively high level of unemployment of university graduates in several countries. Therefore, a new model of futuristic assessment in higher education is deemed necessary. In general, the purpose of assessment is to make valid judgments about students' abilities and competencies in certain domains (Clarence, Quinn & Vorster, n.d). However, the process of seeking and interpreting the evidence of achievement determines where learners are in their learning; what their next learning goals should be and how to achieve them. Hence, it is also poised to review and discuss critically about the present and future trend of assessment. According to the Gordon Commission (2013), a reconceptualization of the epistemology of assessment – from assessment *of* education to assessment *for* education is timely. From using assessment to *evaluate* learning to using assessment to *enhance* learning. Conventional assessment is often linked to the evaluation of an individual learning. By default, conventional assessment is defined as a traditional pencil and paper test to gauge an individual knowledge and skills.

The evolution of assessment from a traditional pencil and paper test to digital assessment has witnessed the challenges in developing psychometric tools to provide accurate, valid and reliable evidence of each student's learning at multiple time points, from different learning sources, varied assessment types, and diverse learning styles (The Gordon Commission, 2013). This article also discusses various perspectives on assessment in education and their meanings; problems associated with accountability, reliability, and validity as a framework for assessment; and the notion of assessment as evidential reasoning (Gorin, nd; the Gordon Commission, 2013). Deep reflection on assessment contributes to ongoing improvement of curricula, course design, and pedagogical methods. It is also important to recognize that assessment is not just an intellectual exercise, but that it has

real effects on the lives of students (Clarence et al., n.d). The intent is to provide practitioners with tangible alternatives to conventional assessment systems that are able to engage and produce more responsive learners (Gordon et al., 2012). This article is also written to stimulate discussion and debate concerning the multiple-dimensional purposes of assessment in education; the possibilities for the improvement of teaching and learning processes and outcomes through the more creative use of measurement in education; visions of future change in the nature and practice of education; and the need for a paradigm shift. Traditionally, assessment in the classroom tends to collect cognitive data – both summative and formative – to provide an indicator of each student's achievement. In the future, digital technology could be used to reduce the testing burden and target assessment for each student based on his/her own relevant learning trajectories (Gordon et al., 2012).

Paradigm Shift in Assessment for Higher Education

The growing emphasis on accountability and transparency that characterizes the new paradigm has led to increased demands for colleges and universities to engage in outcomes assessment for accountability purposes (Secolsky & Denison, 2011). Oldfield et al. (2012: 1) assert that:

> Assessment is universally recognised as one of the most important – and powerful – elements of an educational experience. It is also seen as one of the hardest to reform. However, there is an increasingly demonstrated need for assessment reform, particularly if it is to keep up with other theoretical, cultural and technological developments affecting teaching and learning. Current assessment methods, especially the heavy emphasis and priority afforded to high-stakes summative assessment, are often described as outdated, ineffective and, at worst, damaging.

In the past, assessment of learning outcomes has traditionally been an internal matter for many universities. But now, with the shift toward more universal and internationally-oriented higher education systems, using internal assessments to yield more general information might, without some external check, trigger concerns about grade inflation (Bologna Secretariat, 2012). This is not to imply that conventional assessment of student learning is less important, but the recent trend shows the emergence of new modes of assessment is inevitable. New learning theory suggests that teachers should promote student-centered learning in higher education,

characterized by innovative methods of teaching that involve students as active participants in their own learning. In universities, lecturers should provide a supportive and inspiring learning environment (Bologna Secretariat, 2012). Hence, the emphasis on student-centric learning is to reinforce the interplay between teaching and learning so as to determine effective teaching strategies and to experiment new ideas to enhance students' learning outcomes (McCombs & Miller, 2007). Research scrutiny on teaching-learning processes is prompted by the pressure on costs which call for improving efficiency of higher education's provision. In addition, the need for evidence-based research on effective learning and assessment is evident due to the accountability movement. To have an efficient assessment, Liu (2011) suggests the prominence of measurable outcomes for the evaluation of instructional effectiveness in higher education. In this context, measuring university students' learning outcomes across borders, languages, and cultures is by no means unique or isolated. In fact, it is part of a wider context of a global initiative to promote outcome-based education and assessment. Nevertheless, the over-reaching purpose of assessment in higher education is to improve teaching and learning processes and outcomes by using valid and reliable evaluation instruments. In the future, however, university lecturers as an agent of change should reframe their thinking on assessment to suit future demands (Hersh & Keeling, 2013).

According to Barr and Tagg (1995), higher education is shifting from an "instruction paradigm" – characterized by an emphasis on delivering lectures and providing students with the means to learn – toward a "learning paradigm" in which the emphasis is on the learning process of students (Tremblay et al., 2012). In the new paradigm, the main pedagogy has also been shifted to a learner-centered focus (Cornelius-White, 2007; Weimer, 2002). There is some evidence that academic staff has embraced the principles of a learning-centered philosophy in the United States and they are willing to change their practices to espouse new classroom strategies (Scott et al., 2009; Webber, 2012). Cheng (2009) laments a slower pace in implementing learner-centric reforms in universities in Asia-Pacific region because they are more focused on lecturers' management and professional development. Learner-centric paradigm is also prominent within European Union higher learning institutions, as affirmed in the Bucharest Bologna Communiqué to enhance student-centered learning in higher education, characterized by innovative methods of teaching and learning that involve students as active participants in their own learning (Bologna Secretariat, 2012).

In terms of students' evaluation, The Gordon Commission (2013) states that the current focus is on the fundamental and basic skills of reading, writing, and mathematics, and to a lesser degree on science and liberal arts. So the challenge is to go beyond these basics and consider a wider range of competencies. The Commission also suggests a more integrated approach for teaching, curriculum development, and evaluation that supports students' learning and allows students to move beyond the basics and transfers that knowledge to other contexts transcending the one in which the original knowledge was learned. Hence, the importance of collaboration and recognizing the varying social contexts in which students learn is evident. Assessment, broadly construed, is a central element of education and should be aligned to both teaching and learning goals; it is not the only tool for improving students' outcomes. In fact, in the new paradigm of Education 4.0 for higher education to be effective, universities ought to be redesigned to integrate advanced technology and connectivist philosophy in pedagogy and assessment.

Technology-enhanced assessment (TEA) could be used to measure not only what students know and are capable of doing but also their higher order thinking. TEA is the use of technology to add value to the assessment and feedback processes. Gaming, simulations and artificial intelligence (AI) are examples of new technology in assessment (Kahl, 2015). In the future, artificial intelligent robot or non-human smart assessor could be used to measure students' higher-order thinking. Nonetheless, TEA in the current literature is more focused on online assessment. However, the validity of the online assessment systems used in educational testing to measure students' competence is still questionable. The usage of mixed modes (online and paper) reflects a more realistic tool of assessment in higher education. Furthermore, security issues, limited testing time, and the need to accommodate a large number of simultaneous users have made the online test delivery systems vulnerable (Kahl, 2015). In fact, there have been instances in which online assessment has led to the development and use of lower level questions that can be scored by the existing online systems. There are some advantages and disadvantages of various assessment techniques but almost all assessment techniques have weaknesses, and there is no single assessment technique that results in a perfect assessment. Finding the right assessment method depends on the aim of the assessment in terms of skills or knowledge that needs to be evaluated.

Principles of Assessment

By default, assessment is often defined as a process of gathering data. More specifically, in higher education,

assessment is a means for lecturers to collect relevant information about their teaching and their students' performance (Hanna & Dettmer, 2004). Assessing generally refers to the process of collecting critical information about an individual's knowledge, competencies and attributes, either in formal or informal learning contexts (Shute et al., 2009). Hence, a valid and reliable tool to collect such data is required. The basic functions of an assessment tool are to diagnose and to predict competencies and capabilities of an indivdual. The data provide a picture of a range of activities using varied forms of assessments such as quiz, final examination, observation, and feedback. Once these data are gathered, the lecturer can then evaluate the student's achievements. Evaluation, therefore, draws on one's judgment to determine the overall value of an individual's worth based on the assessment data. It is also a decision-making process to improve the weaknesses, gaps, or deficiencies of an individual (Hanna & Dettmer, 2004).

Since assessment is, basically, a claim about an individual's competencies, it should be treated as a process of gathering evidence to confirm or refute a particular claim. That evidence, could come from multiple sources and can be used to improve both how and what the individual is learning. The evidence might include activities ranging from simple to complex performance tasks pursued within classrooms as well as assessments external to regular classroom activities. According to the Gordon Commission (2011), the objectives of assessment fall into two general categories: first, assessment *of* learning generally involves an evaluation of a student's achievement after a period of instruction. Such assessment could be used to consider admission to a university or other opportunities, to appraise programs or to assess approaches. Second, assessment *for* learning involves a more restricted and focused appraisal of student knowledge during a shorter period. It is designed for purposes such as adjusting and improving instruction.

Table 1 shows general principles of assessment in higher education. A lecturer could use a variety of assessment techniques including authentic assessment that clearly reflects the participatory, learner-centered, and task-based approach to learning (Classroom Assessment, 2004). The percentage of the mark assigned to each component of the curriculum should reflect the amount of time that the students spend on that component. If students are spending 30% of their time on group activities, 30% of their final mark should be determined by group evaluation. Theoretically, a test should measure what it claims to measure. Varied modes of learning outcomes should be evaluated in different ways. For instance,

knowledge-related learning outcomes can be assessed by objective tests but attitudes are better assessed by observation and feedback. Students should be involved in determining the criteria that will be used for evaluating their work. This can be part of the planning process before the lesson starts. Students should have a clear understanding of the types of evaluation procedures that will be used throughout the lesson.

Besides conventional cognitive assessment such as standardized tests, authentic assessment could be used to measure deeper knowledge and skills. Authentic assessment includes those alternative evaluation tools in higher education systems that are able to engage and produce more responsive learners (The Gordon Commission, 2012). Authentic assessment can measure cognitive achievement and ability of individuals based on their deep understanding, higher-order thinking, and complex problem-solving skills. Authentic assessment tends to focus on real-world contextualized tasks, enabling students to demonstrate their competency in an authentic setting. Examples of authentic assessment include solving real problems, creating products or portfolios, or making simulation. Therefore, it is a powerful tool for assessing a student's 21st century abilities and competencies. Authentic assessment requires a student to develop his or her own answer in response to a stimulus or prompt which is called a constructed-response assessment (Stecher et al., 1996).

Assessment tools and techniques used to appraise students will depend largely on what is being evaluated. Students can be assessed by observing them as they are engaged in classroom activities, by measuring how well their work meets specific criteria, or by giving them different kinds of test (Classroom Assessment, 2004). Students could be assessed individually or in groups. The assessment could be conducted by the lecturer, by the student himself or herself, or by other students. Varied assessment tools such as anecdotal records, checklists, seminars, performance assessments, peer evaluations, portfolios, rating scales, rubrics, and online assessment could be used. Anecdotal records are systematically kept notes of specific observations of student behaviors, skills, and attitudes in the classroom. Systematic collection of anecdotal records on a particular student provides excellent information for evaluation of learning patterns and consistency of student progress. Well-kept anecdotal records provide a valuable, practical, and specific reference about a student's competencies. Akin to anecdotal records, portfolio as a purposeful collection of a student's works that exhibits the student's efforts, progress,

and achievements in one or more areas (Classroom Assessment, 2004).

Checklists, rating scales, and rubrics are assessment tools that state specific criteria that allow lecturers and students to make judgments about an individual's competence. Checklists list specific behaviors, knowledge, skills, attitudes, and strategies for assessment, and offer systematic ways of organizing information about individual students or groups of students. Checklists usually offer a 'yes' or 'no' format in relation to the specific criteria and may be directed toward observation of an individual, a group, or a whole class. Checklists may be single-use or multiple-use. Rating scales allow for an indication of the degree or frequency of the behaviors, skills and strategies, or attitudes displayed by the learner. Rubrics are an expanded form of rating scale that list several specific criteria at each level of the scale. The quality of data acquired through the use of checklists, rating scales, and rubrics is highly dependent on the quality of the descriptors selected for the assessment. The benefits are also dependent on students' direct involvement in the assessment and interpretation of the feedback provided (Classroom Assessment, 2004). In the same token, seminars could provide opportunities for students and lecturers to discuss learning challenges and areas for improvement, and to set learning goals. Seminars are usually short informal meetings held with individual students, or a small group of students, and involve diagnostic listening, questioning, and responding. Interview, on the other hand, is a technique to gather specific information. Interview protocols comprised a set of questions that an interviewer asks for a specific purpose. Finally, performance assessments are concerned with how students apply the knowledge, demonstrate skills, and strategies to solve a specific problem. The problem could be content-specific or interdisciplinary and relate to real-life application of knowledge, skills, and strategies.

For future assessment, the principles of good assessment are unlikely to change even though examinations or qualifications change. In fact, the fundamentals of what makes good assessment will not change (Burdett, 2016). Good assessment must reflect everything that is considered pertinent to a good education. Simply put, good assessment cannot be divorced from good education. It is critical to get both right, and to understand the complex interplay between them. Valid assessment is not only designed to measure accurately the target audience but more importantly to find appropriate strategies to improve learning. As succinctly explained by Burdett (2016:14):

Table 1: Principles of Assessment

Assessment…	Assessment…	Assessment…
1. An Integral Part of Instruction and Learning	**2. Continuous and Ongoing Process**	**3. Authentic and Meaningful Learning Processes and Contexts**
• is meaningful to students • leads to goal setting • fosters integration with other curricular areas and application to daily life • reflects instructional strategies used • uses a wide variety of methods • reflects a definite purpose	• occurs through all instructional activities (observations, conferences, responses, logs) • occurs systematically over a period of time • demonstrates progress toward achievement of learning outcomes	• focuses on connecting prior and new knowledge (integration of information) • focuses on authentic context and tasks • focuses on application of strategies for constructing meaning in new contexts
1. Collaborative and Reflective Process	**2. Multidimensional, Incorporating a Variety of Tasks**	**3. Developmentally and Culturally Appropriate**
• Encourages meaningful student involvement and reflection • Involves parents as partners • Reaches out to the community • Focuses on collaborative review of products and processes to draw conclusions • Involves a team approach	• Uses a variety of authentic tasks, strategies, and tools • Is completed for a variety of purposes and audiences • Reflects instructional tasks	• Is suited to students' developmental levels • Is sensitive to diverse social, cultural, and linguistic backgrounds • Is unbiased
1. Focuses on Students' Strengths	**2. Based on How Students Learn**	**3. Offers Clear Performance Targets**
• Identifies what students can do and are learning to do • Identifies the competencies in the development of knowledge, skills, and attitudes • Considers preferred learning styles • Focuses on celebrations of progress and success • Provides for differentiation • Provides information to compare a student's performance with his / her other performances	• Uses sound educational practices based on current learning theory and brain research • Fosters development of metacognition • Considers multiple intelligences and learning styles • Uses collaborative and cooperative strategies • Considers research on the role of memory in learning • Reflects current models of language learning	• Encourages student involvement (setting criteria, measuring progress, working toward outcomes and standards) • Encourages application beyond the classroom • Provides a basis for goal setting • Provides students with a sense of achievement • Provides information that compares a student's performance to predetermined criteria or standards

Source: Classroom Assessment (2004)

Good assessment does not mean valuing only what we can measure well, but finding ways to measure what we value.

Given the paradox that surrounds education and assessment, nationally and internationally, it is hard to state categorically what "good assessment" is – values and cultural influences blur the borderlines – but good educational assessment needs to meet some basic criteria (Bassett, 2015). Assessment needs to have a clearly defined purpose. Next, it must be fit for that purpose – it must measure what the learners have learned. In other words, ensuring the validity of the assessment is critical. Most importantly, but often overlooked, good assessment should follow medical principle of *primum non nocere* – it should do *no harm*, in this case to the learners (Burdett, 2016). In universities, designing curricula and assessments often takes an integrated view with assessment as a central part of the learning experience. Other factors such as styles of learning and teaching, pedagogic skills, and assessment literacy are also indispensable. In short, good assessment is inextricable from good learning (Bassett, 2015). According to Bennett (cited in The Gordon Commission, 2013), assessment for education ought to:

- Provide meaningful information
- Satisfy multiple purposes
- Use modern conceptions of competency as a design basis
- Align test and task designs, scoring, and interpretation with those modern conceptions
- Adopt modern methods for designing and interpreting complex assessments
- Account for context
- Design for fairness and accessibility
- Design for positive impact
- Design for engagement
- Incorporate information from multiple sources
- Respect privacy
- Gather and share validity evidence
- Use technology to achieve substantive goals

In addition, feedback is another important element in higher education assessment (Wilson & Scalise, 2006). A major literature survey of over 250 sources on formative assessment (Black & Wiliam, 1998) found that effective assessment practices can play a powerful role in the learning experience and in improving a student's performance – but only if certain conditions are satisfied. Student tasks needed to be aligned, or on target, with learning goals, and students need to receive meaningful and timely feedback on their performance, as well as targeted follow-up work. To effectively monitor their learning, students should understand three main aspects regarding how they would be assessed: (a) the measures on which they will be judged, (b) where they stand on these measures, and (c) how they can improve (Black & Wiliam 1998; Wilson & Scalise, 2006).

According to Knight (1995), summative assessment in higher education has fallen into disarray, which requires a reappraisal of the assessment system. In general, educators are faced with the difficulties in understanding assessment issues. Basically, education is about learning, higher education is concerned with certain sorts of valued learning. Curriculum specifies the skills and understandings that are valued and, increasingly, identifies desirable outcomes and dispositions (Dweck, 1999). Hence, students in higher education might be expected to understand material of importance in a subject area; to develop subject-specific and general skills; to become more confident; and to reflect and think strategically. There is a strong evidence that student achievement is related to engagement (Astin, 1997). However, engagement does not simply equate to the amount of involvement in and time on task; it extends to learners' engagement in communities of practice, to their involvement in a variety of networks and to the amount and quality of interchanges with others.

Besides engagement, feedback is also critical in assessment. Knight (1995) asserts that it is helpful to distinguish between assessment systems primarily intended to provide feedout and those intended to provide feedback. Feedout is focused on summative or high stakes assessment, which is supposed to be highly reliable. When an assessment certifies or warrants achievement it has a feedout function, in that the marks and/or grades could then be treated as a sole performance indicator for the student. The summative assessment often focused on cognitive domain and ignored other domains such as creativity and artistic ability. Relying heavily on summative assessment and using it as a feedout is quite risky. According to Knight (2002), careless or capricious feedout is unethical and could be challenged.

Assessment also has a feedback function when it is intended to improve learning. If Knight (1995) argued that summative assessment is in disarray, then the feedback functions should be reappraised, thereby putting consideration of the place of assessment in higher education in a fresh light.

Feedback is supposed to be an interactive process between a teacher and a learner. Of course, there are other types of feedback such as peer feedback. In the contexts of teacher-student feedback, formative feedback is to assist students to improve their work and prevent them from making the same mistakes. Summative feedback comprised a teacher's comments on the students' specific work and the teacher's explanation on how the marks were derived (www.federation.edu.au). In order for feedback and reflection process to work, an element of trust must be there. According to Davis and Dargusch (2015), teachers need to safeguard the trust of their students. Lack of mutual trust can negatively influence the feedback process. In the same token, in assessment, trust is pertinent.

Literature has shown that there is evidence of mistrust regarding the accuracy of the assessment outcomes especially when it comes to university graduates. According to Knight (2002), assessment is supposed to supply evidence to bridge the trust gap with the belief that it is prudent to specify objectives, measure inputs, assess performance in terms of those objectives, allocate the next round of resources to efficient providers and apply sanctions to the less efficient. Lecturers should be assessment-savvy since assessment is related to upholding standards and also related to the enhancement of quality of the graduates. Due to public's low-trust and risk-averse perception on the assessment data, it becomes evident that summative assessment systems are less likely to provide the robust performance indicator (Knight, 2002).

Assessment is a vital barometer of a didactic process, as it provides measurable evidence of learning. However, some scholars in the field have criticized that the current assessment practices especially in higher education have deviated from their core purpose - to support learning (Timmis et al., 2016). In fact, assessment is often seen to be preoccupied with qualifications and narrow achievements, and critiques of current assessment systems are numerous (Attwood & Radnofsky, 2007; Schwartz & Arena, 2009). These criticisms have pushed for reform, which is backed by a growing understanding of what constitutes effective assessment and how to accurately measure students' learning. New learning theories have

contributed to a deeper understanding of the relationship between feedback processes and effective learning (Whitelock & Watt, 2008; JISC, 2010). Such developments have particularly acknowledged the importance of learner self-regulation and peer-assessment in deeper engagement and effective learning. Another emphasis on developing and assessing characteristics and dispositions of learners that augment more traditional areas of the curriculum – often labeled as 21st century skills – has also become a familiar mantra within the field (Oldfield et al., 2012).

Historically, based on the theory of classical measurement, assessment was constructed to evaluate students' ability and achievement. And assessment also could be used in the service of accountability, selection, and certification (The Gordon Commission, 2013). In a traditional paradigm, Kaestle (2012) acknowledged the power of standardized, multiple-choice tests due to their cost effectiveness and efficiency as compared to the more complex, more subjective and higher-level assessments. Shute et al. (2010: 4) succinctly put:

> When confronted by problems, especially new issues for which solutions must be created out of whole cloth, the ability to think creatively, critically, collaboratively, and then communicate effectively is essential. Learning and succeeding in a complex and dynamic world is not easily measured by multiple-choice responses on a simple knowledge test. Instead, solutions begin with re-thinking assessment, identifying new skills and state standards relevant for the 21st century, and then figuring out how we can best assess students' acquisition of the new competencies – which may in fact involve others doing this assessment (e.g., community, peers).

The challenge particularly relevant to this article is what kind of assessment drives the teaching that supports the competences and dispositions that we think matter. Inherent to the discussion of how to embed skills, knowledge, dispositions, and literacies into education is how they should be assessed. A 2005 survey of educational assessments that support the 21st century learning notes that the movement to embrace and foster widespread adoption of the new skills hinges on identifying ways to assess students' acquisition and application of this knowledge and there is a comparative lack of assessments and analyses focused on elements of 21st century learning (Honey et al., 2005). Hence, there is a critical need to further develop new assessment tools that measure higher-order, more complex thinking – such as the application of knowledge to complex situations (Honey et al., 2005; Shute et al., 2010).

One of the main issues of the current assessment practices is that most assessment instruments are identified as difficult to calibrate, measure, and evaluate. This may be in part because they can be seen as too generic or vague to measure performance in any meaningful way. Bennett and Barker (2012) make a similar argument into the complexity of measuring the higher-order thinking skills of the students. Conventional assessment systems therefore are often measuring what is easy to assess rather than what has been learned. Shute et al. (2010) proposed psychometric models that can evaluate certain competencies and use immersive learning environments to elicit and measure data related to these skills. Recognizing that current immersive approaches lack an assessment infrastructure to maximize learning potential, Shute et al. (2010) conducted a significant literature review to determine relevant competencies to assess. They chose to develop competency models for systems thinking, creativity, collaborative learning, and managing social identities and reduced each one to a granularity that could be measured in order to diagnose different levels of competency. Using a process called "evidence-centered design" (ECD) to support the validity of the assessments they devised, the researchers designed immersive learning environments by listing the knowledge, skills, and attributes that should be assessed, identifying behaviors that demonstrate these elements and crafting tasks that should elicit these behaviors and create the assessment evidence. They then measured the competencies within immersive learning environments that provide valid assessment to support students' learning via formative feedback, collaboration, and personalized content (Shute et al., 2010).

According to Gordon et al. (2012), even though the 3Rs – Reading, wRiting, and aRithmetic will continue to be essential skills but the 21st century skills emphasize more on the "Cs" as essential processes in education. The Cs such as creativity and innovation, conceptualization and problem-solving, communication and collaboration, and computer literacy. The Cs are replacing the "Rs" as the contemporary learning paradigm moves toward 21st century skills. Learning how to think critically and creatively, reason logically, interpret relationally, and to access and create knowledge will be more distinctive in the new millenium. However, traditional testing is not designed to measure students' higher-order thinking skills (Kahl, nd). Hence, the Gordon Commission (2013) recommends developing "holistic" methods for assessing students' knowledge, skills, and higher-order thinking. Diverse contexts for assessment especially in higher education are a significant challenge for educators. The growing concern for context, perspective, and situated meaning that is

associated with postmodern theory constitutes a possible challenge to higher education and its assessment systems. In addition, the tensions between the positivist traditions that focused on psychometric measurement and the post-positivist and neo-pragmatic post-modernist test theory that seemed to be more appropriate to contemporary conceptions of "qualitative" assessment in education are evident (The Gordon Commission, 2013). Hence, the rise of formal and informal assessments due to varied assessment paradigms is expected.

Nevertheless, two key issues appear as significant challenges in assessment in higher education. First is the issue of constructing valid and accurate instruments to measure the 21st century skills. Second, is the issue of technology usage in assessment in higher education (Kahl, 2015). Specifically, the students' lack of higher-order thinking skills and their poor ability to apply foundational knowledge and skills to more complex real-world problems are alarming. Furthermore, online testing commonly used in universities has tended to focus on low-level, isolated knowledge and skills, and the students are not ready to participate in high-stakes online testing. Pellegrino and Quellmalz (2010) believe that there is a symbiotic connection among theory, research, technology, and practice, especially when it comes to the integration of curriculum, instruction, and assessment. The increasing influence of digital worlds means that young people are seen to be taking on new participatory and collaborative roles in learning online and outside the classroom, and there is a growing interest in incorporating these roles and practices inside education. Bennett (2002) argued that the incorporation of digital technology into assessment is inevitable. However, as has been demonstrated by the introduction of new digital technologies, the view that educational reform through technology is usually hampered by the inefficiency in implementation and complexity of change in education systems. In addition, Bennett (2002) acknowledged that the incorporation of technology into higher education assessment may not be easy. But educators must deal with it and TEA is considered as an alternative assessment.

Alternative Assessment

As a response to educators' dissatisfaction with multiple-choice and other types of standardized tests, alternative types of assessment were introduced. Alternative assessment is not only designed to measure the learning outcomes but also students approach to their learning (Murphy, 2009). Early assessment – particularly when it provides students with timely feedback – is focused on providing input on students' strengths and weaknesses. It also gives lecturers an indication of how effective their teaching approaches are in terms of students' comprehension. Effective feedback on work submitted is crucial in helping students learn by pinpointing their weaknesses and what they need to do to improve. Alternative assessments range from written essays to competency-based assessment to portfolios. In the 1990s, alternative or more commonly known as authentic assessment has been introduced in higher education. As a realistic tool, authentic assessment measures a student's creative problem-solving skills based on a real problem. Now, in this cyber era, digital tools can be used to assess students' creativity and higher-order thinking skills. Hence, technology-enhanced assessment (TEA) has the potential to reform assessment systems. The current literature suggests it is vital to integrate TEA, shifting the focus from traditional assessment practices to the current TEA to improve learning. Digital experts are offering tips to improve assessment and to advance the debate on how TEA could facilitate such reform. Digital tools could be used for measuring complex thinking skills and learning processes, such as immersive learning environments like simulations and digital games, web tools, use of mobile and handheld devices, learning apps, and social media (Pellegrino & Quellmalz, 2010). Mobile-based inquiry and mobile-based assessment could be a new learning and assessment trend (Suarez et al., 2018).

In the digital age, technology is a catalyst for learning and a platform for assessment. Digital technology has prompted the development of advanced and comprehensive assessment systems. For instance, digital technology provides a platform to collect and manage big data gathered throughout the teaching, learning, and assessment process that could be used to map the progression of students learning (The Gordon Commission, 2013). According to Timmis et al. (2016), the idea that digital technologies will transform education and specifically assessment is not a new one. Novel technologies and digital tools open up new possibilities in educational assessment, such as offering more personalized, instantaneous or engaging assessment experiences. In a number of cases, these possibilities have been realized and demonstrated benefits. However, the literature suggests that the use of digital technologies has yet to be transformative and is often used via traditional assessment methods or within pockets of innovation that are not widespread. In addition, it is critical to understand how technologies could support or spur educational changes and what affordances are most useful to support the outcomes that educators

envisage within the current educational context. Even though the potential of digital technologies is evident, we should not be naïve about the complexity of the digital transformation especially in digital assessment. For instance, the ethical questions raised by the use of digital technologies in assessment, such as the collection, use, and protection of the large personal data sets, as well as how the use of these tools could reinforce inequalities within education. So, the question becomes how to mobilize a new vision for assessment that includes the use of advanced technology (The Gordon Commission, 2016).

Technology can enhance students learning when used in conjunction with active engagement, strong participation in groups, high interaction and feedback, and seamless connections to real-world contexts (Roschelle et al., 2000). Online resources such as digital games could enhance students' thinking skills if it is used to solve complex problems. In addition, the use of games allows lecturers and students to augment boring lesson with timely, meaningful contexts, and individualized instructional experiences (Quinn & Valentine, 2001). In gaming, students are more likely to use strategic thinking creatively in order to win a competition. An online platform will make it possible to deploy and manage students learning and assessment in a cost-effective way while minimizing additional burdens for lecturers, students, and administrators. Gamification would be much more interesting than a traditional system for teaching and learning (Gordon et al., 2012). However, digital assessment for the gamification is still at its nascent development. Therefore, the validity of digital assessment could become an issue.

Shaffer and Gee (2012) proposed GATE (Good Assessment for Twenty-first-century Education) – a new assessment system using games. Games have changed learning. Good principles for learning are even more important in the 21st century, where students need to learn to work with others and with digital tools to solve problem and not just to memorize facts. The 21st century skills like innovation, critical thinking, and systems thinking could be measured using GATE. Digital technologies – including games – are letting young people to learn and solve problems and to actively participate in higher-order learning process. Through the internet, young people are becoming amateurs with professional level skills in areas like storytelling, graphic arts, game design, photography, and robotics (Leadbeater & Miller, 2004). GATE utilized games like *Sims* and *Urban Science* to measure students' higher-order thinking, problem-solving skills, and creativity (Shaffer & Gee, 2014).

Reframing Assessment in the 21st Century Learning

Assessment is changing rapidly, unprecedented in the history of psychometrics. Future assessment focuses on the dynamic problem-solving and critical thinking skills associated with using technology to enhance students' 21st century skills. But what actually are we measuring? - is it the students' memory or their problem-solving skills? The traditional notion of examination to measure their knowledge and understanding may be useless with the ubiquitous availability of smart computers with fastest search engine and android phones where the students could find any information instantaneously to answer almost all the traditional examination questions. Future learning such as using virtual learning environment (VLE), virtual reality and augmented reality will be dominant in the future learning especially in high-risk tasks and performing complex procedures (JISC, 2010; Kumar, 2017). VLE is an online system comprising a range of tools to support learning and the management of learning. And, the mixed-reality platform (VR and AR) would be used to trigger just-in-time learning (Kumar, 2017). Just-in-time assessment would also be possible to respond to just-in-time learning. E-universities would be expected to invest and explore the advanced learning and digital assessment methods. The advent of intelligent assistant in smart phones such as Siri or Galaxy would enhance the use of machine-enabled-learning chatbots (Kumar, 2017). In addition, gamification will continue to be critical domain. Game-based learning and gamification have greater impact in imparting critical information. According to Kumar (2017), gaming increases the "focus" in learners as they immerse themselves in the process of gaming. Often time, gamification is designed to attract students to invest their time and energy in a challenging activity. In other words, learning and assessment become more mobile. Mobile-based learning, inquiry and assessment are a way forward.

In a contemporary society, emphasis is given to the importance of knowledge repertoire and its role as a basis for relating to new chunks of knowledge. There is a growing demand for the capacity for adaptability and disposition to improve learning and assessment. Bereiter and Scardamalia (2012) have identified five critical competencies for university students: (a) knowledge creating where students are able to build, amend, and create knowledge, (b) working with abstractions where students should be able to work with abstract ideas and convert them to real world applications – going from the theoretical to the practical, (c) systems thinking where students should be able to recognize and understand the complexity of the world and consider how to take advantage of the complexity whenever possible, (d) cognitive persistence

where students should be able to sustain focus on their study in the face of increasing obstacles and distractions, and (e) collective cognitive responsibility where students should be able to engage in collective work that is collaborative (cited in The Gordon Commission, 2013). Hence, learners should be given instructional space to collaborate, and assessment could be adapted to individual and collaborative efforts to solving problems that could be measured and evaluated. Furthermore, the Gordon Commission report (2013) recommends preparing learners to engage in lifelong learning and enabling them to gain new competencies while adapting them to the accelerating pace of change.

In the era of globalization and the advent of the digital age, there is a paradigm shift occurring in most universities' curriculum and academic structure. Apart from the creation of new programs, the approach and orientation have also been shifted from input-based education to outcome-based education. The criteria for the new generation of quality graduates have been much broadened (Chung, 2011). A pertinent question is how assessment can be used most effectively in the 21ˢᵗ century to advance that vision by serving the educational needs of university students, institution and society? And also to stimulate a debate about assessment and its relationship to teaching and learning in the face of technological advancement. Through rigorous debate and deep reflection, it could provide an opportunity to reframe the purposes of educational assessment (The Gordon Commission, 2013). Based on the literature review, TEA benefits to learning and specifically to assessment are well documented. Several scholars (Angus & Watson, 2009; Pellegrino & Quellmalz, 2010; Schwartz & Arena, 2009; Whitelock & Watt, 2008) have highlighted the benefits associated with the integration of TEA. Reframing conventional assessment in higher education could be done by integrating digital technology in assessment as follows:

- **Provide immediate feedback** – TEA offers "real-time" learner-led feedback that diagnoses and reduces misconceptions quickly and provides more opportunities to act on feedback from a range of audiences. This can also lead to useful and new forms of teacher and learner dialogue, improvements of the assessment experience and increased student engagement.
- **Increase learners' autonomy, agency, and self-regulation** – TEA supports more personalized responses to work and progress and could facilitate self-evaluative and self-regulated learning through diverse collections of evidence, immediate formative feedback, better tracking of progress to learning outcomes and reflection on achievements. The visualization of data is particularly relevant.

- **Support for collaborative learning** – TEA offers opportunities for peer assessment, undertaking and tracking knowledge building and sharing activities, co-evaluation, and social interaction.
- **Provide authenticity** – TEA provides ways to assess complex skills like problem-solving, decision making, and testing hypotheses, which is argued to be more authentic to future work experiences and what skills and knowledge will be required after formal education.
- **Widen range of measurement** – TEA creates and analyzes complex data sets that have previously been difficult to assess. For example, simulations can simultaneously measure technical computer skills, decision-making and strategy processes as well as subject specific skills like scientific enquiry. These also include tracking cognitive processes that can be developed into patterns showing levels of expertise.
- **Provide flexibility and appropriate responses** – TEA offers choice in approach, format and timing of assessment for students. They can access assessment at a time and place of their own choosing, with no constraints due to time or location. Additionally, digital tools like simulations provide multiple modalities and could offer more accessible assessment than text-based tests for students with varied learning styles or language backgrounds. Regular feedback can also make students feel less anonymous and more personally connected to their learning and courses, particularly in university settings. These possibilities can also challenge traditional methods of assessment and require a rethink of old practices.
- **Increase efficiency and reduce teachers' workloads** – TEA improves efficiency of data management such as marking, moderating and storing information by helping teachers use their time and resources better; offers more environmentally friendly administration of assessment.
- **Improve student performance by using e-feedback** – TEA improves student performance and demonstrates other benefits, such as better student engagement.
- **Integrate formative assessments** – TEA can integrate instruction and assessment, as in immersive learning environment or programmes that monitor how students solve problems on the computer and provide immediate feedback.

Future of Assessment in Higher Education

Today's world has witnessed the emerging paradigm by which goals and processes of assessment in higher education are changing. Traditional psychometrics associated

with educational measurement, such as reliability, validity, and fairness, may require reconceptualization to accommodate changing conditions, conceptions, epistemologies, demands, and purposes of the future assessment in higher education. The traditional conceptions of what it means to educate and to be an educated person are changing. Notions of and demands on practice in the teaching and learning enterprise are broadening and expanding. And the concern with accountability forces this dynamic and eclectic enterprise to constrict and, in some cases, to compromise in the interest of meeting certain accountability criteria. These realities, coupled with changes in epistemology, cognitive and learning sciences, as well as in the pedagogical technologies that inform teaching and learning, are narrowing – possibly even stifling — creativity and flexibility in teaching and learning transactions. These are among the perceived compelling contextual problem. Changing concepts and practices in educational assessment are making some traditional practices in psychometrics obsolete. The work of the Gordon Commission (2013) rests on the assumption that assessment in education can inform and improve teaching and learning processes and outcomes. In terms of the educational assessment policy, practice, and technology; consider what will be needed from educational measurement in the 21st century; and to generate recommendations on educational assessment design and application that meet and/or exceed the demands and needs of education — present and future.

According to the Gordon Commission (2013), the future of assessment in higher education would be influenced by critical research findings, psychometric advancement, and digital technology. Higher education assessment will need to keep pace if it is to remain relevant. It is predicted that the future of assessment will be digitized, personalized, and possibly gamified requiring significant adapting and reinventing educational assessment. A significant challenge as a field will be to retain and extend foundational principles, applying them in creative ways to meet the demands of the digital era (The Gordon Commission, 2013). If assessment in higher education is to remain relevant, future educational assessment systems will also need to provide trustworthy and accurate profile of the graduates' knowledge and competencies to future employers. Future assessments in higher education should be robust in documenting graduates' abilities in their content and related fields. Even at this present time, increasing demands for graduates with digital competence are anticipated.

In the 20th century, testing and measurement to evaluate individual's abilities dominated the assessment systems.

But in the 21st century, assessment is digitally enhanced to determine holistic human capabilities. Assessments in the new age may comprise diagnostic, prescriptive, instructive, responsive, and/or digital tools that are capable of capturing an individual's abilities and potentials (Timmis et al., 2016). Furthermore, innovation in assessment is adopted in higher education mainly due to the advent of digital paradigm. But the challenges of integrating technology in assessment are still unfinished agenda. The barriers that could hinder the wider adoption of technology enhanced assessment have been highlighted by several scholars (Mansell, 2009; Mogey, 2011; Ripley, 2007; Timmis et al., 2016; Whitelock & Brasher, 2006; Whitelock & Watt, 2008). Examples of obstacles include:

- Potential barriers to the adoption of technology enhanced assessment practices
- Practitioner concerns about plagiarism detection and invigilation issues
- Difficulties in scalability and transferability of practices, particularly in higher education when different departments often have autonomous, separate working practices and cultures
- Concerns over reliability and validity of high-stakes assessment (such as how to ensure all students receive equivalent tests if questions are selected at random from a question bank)
- User identity verification and security issues
- Lack of lecturer's time and training for rethinking assessment strategies and how to use new technologies, from a technological and pedagogical perspective
- Cost of investment - Implementing new technology systems requires significant investment in training, support and interoperability. Additionally, some tools require large capital investment and infrastructure that many institutions do not want to prioritize (for example, having enough computers for those taking exams for on-screen testing)
- Examination boards are highly concerned with ensuring standards are not compromised
- Lack of policy leadership and system-wide imperatives
- Constraints within the examination systems
- Lack of suitable physical spaces for technology enhanced assessment, which have not developed for the needs and purposes of technology enhanced assessment.

According to Timmis et al. (2016), despite substantial challenges facing those promoting technology enhanced assessment, some studies have identified characteristics of successful TEA implementation and engagement. Beevers (2011) found that projects with solid planning with clear pedagogic needs and supportive

leadership are more likely to be successful. Whitelock and Brasher (2006) note the following enablers: active leadership and management support, pedagogical and technical support for lecturers, and solid staff development. Individuals who champion technology integration in education are also involved in assessment projects, especially regarding summative assessment (JISC, 2010). For instance, the REAP project (www.reap.ac.uk) suggests multiple strategies that are crucial when improving assessment practice, including conceptual frameworks for assessment, supportive institutional policies and departmental initiatives, student engagement in the process and quality assurance procedures to evaluate the entire process. Even though assessment innovations using digital and mobile technology were promising with potential usage but they could be a disappointment in reality if the educators in universities are reluctant to use them (Timmis et al., 2016). Nevertheless, such situation should not discourage a deeper look at the possibilities for future digital assessment. In the future, assessment especially in higher education could be ubiquitously conducted by artificial intelligent devices and mobile androids. In line with connectivist philosophy that emphasizes on autonomy, diversity, openness and interactivity, TEA is a way forward. Hence, new epistemological rationale for reframing higher education assessment is required.

Conclusion

This article reviews the crucial initiatives at improving assessment in higher education. It has highlighted the complexity of assessment because it could serve multiple purposes. There is less consensus concerning the possibility that a single test should be used, however, the consensus holds concerning the need for balance in the attention given to the use of assessment for different purposes. In contrast to traditional view, most people equate assessment with a grade but assessment in higher education now assumes that assessment could improve or hinder learning. Hence, no single framework should be permitted to distort the multi-function of assessment. Similarly, trust is a pertinent issue in dealing with assessment. Traditionally, assessment in higher education is designed to inform and improve teaching and learning processes and outcomes, without ignoring the importance of accountability. In the new paradigm, lecturers are encouraged to reflect critically on their current assessment practices. Literature and research on assessment in higher education have shown a critical need for lecturers to re-think their assessment methods and approaches. In other words, future assessment is not only regarded as a tool to measure learning

but also as a way to support learning. Future assessment tends to measure creativity and higher-order thinking. Hence, the future of assessment will be influenced by the R&D output and the technological advancement. Different from traditional assessment, 21st century assessment in higher education tends to integrate advanced technology in assessment. Digital learners master content faster, are independent and have greater control of their learning and are better problem-solvers. Hence, future assessment should be designed to tailor the new characteristics of the digital learners especially in higher education. Based on connectivist philosophy, future assessment systems should also consider the diversity of the students by providing appropriate and relevant tools that will enable universities to recognize the dynamic knowledge and competencies of the students. In addition, assessment results should have pertinent implications for future learning. Dynamic and responsive assessment is needed to provide appropriate and timely feedback to students for meaningful improvement. This new perspective of assessment will require the training and employment of broadly educated specialists in digital technology, learning, cognition, measurement and assessment. It is recommended that the government and private philanthropies should increase the number of scholarships for doctoral and post-doctoral scholars dedicated to the development of future assessment tools. The present assessment in higher education will need to keep pace if it is to remain relevant. Future assessment is expected to be digitized, personalized, and possibly gamified that require significant adapting and potential reframing of educational assessment. A key challenge in the field is to retain and extend foundational principles but at the same time applying them in creative ways to meet the demands of the digital world. If assessment in higher education is to remain relevant, the system will also need to provide trustworthy and accurate information of the graduates' knowledge and competencies to the future employers. Future digital assessment will be an integral and vital part of a learning system in the sense that it can provide accurate profile of the students' capabilities, talents and aptitudes for them to chart their future career pathways. To achieve that goal, reframing assessment to support teaching, learning, and human development using futuristic assessment tools is critical and it requires deep-thinking and rigorous research. In sum, mobile-based learning, inquiry and assessement are a new way forward.

Competing Interests

No potential conflict of interest was reported by the author(s).

Acknowledgements

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Biographical Statement of Author

Ramlee Mustapha is a Full Professor of Technical and Vocational Education at the Faculty of Technical and Vocational Education, Sultan Idris Education University (UPSI). He was a former Dean for Post-Graduate Studies at UPSI.

He holds a degree in Chemical Engineering (BSChE) from University of Alabama, USA. His first Master degree in Educational Administration (M.Ed) from Eastern New Mexico University, USA and his second Master degree in Industrial Technology (M.Sc) from Purdue University, USA.

He earned a PhD in Curriculum and Instruction (Vocational Education) also from Purdue University, USA.

Professor Dr. Ramlee Mustapha
Faculty of Technical and Vocational Education
Sultan Idris Education University (UPSI)
Malaysia

E-mail: drramlee@yahoo.com