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Foregrounding the prototype design of a generic differentiated assessment tool for mixed-ability classroom

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Abstract: Acknowledging that students vary in terms of their learning abilities – culture, socioeconomic status, gender, motivation, and needs per se, has increased instructors' awareness on mixed-ability classroom. Realizing the need for a personalized learning, many instructors have started to embark on differentiated learning and instruction to capitalize students' ability. However, few research studies have been carried out on differentiated assessments. Differentiated assessments allow teachers to provide opportunities to students with diverse characteristics and backgrounds to prove that they have learned, but at their own pace and ability, though (NSW Education Standards Authority, n.d., Tomlinson, 2001). However, there is no generic, systematic and dedicated tool available yet for instructors to achieve and employ the differentiated assessment. In the context of Universiti Putra Malaysia, current evaluation practices do not provide a precise insight into the true level of CO (Course Outcome) achievement for each student as a standard test/examination is given to students despite their mixed learning ability. Identifying students' learning ability, at the first place, is also a challenging task and the process can take a long time. Therefore, it is timely to create a dedicated tool for differentiated assessment that can address these issues and challenges. Against this background, this research will develop a prototype of a generic, systematic and intelligent tool that has two-fold objectives: (i) the system allows instructors to employ differentiated assessment across courses or programmes, and (ii) it provides opportunities for students to execute tasks or complete an assessment by choice based on their actual ability. This effort is in line with UPM's agenda to expand alternative assessment across courses and programmes.

Keywords: Alternative Assessment, Differentiated Assessment, Mixed Learning Ability

1. Introduction

> Ensuring rock solid clarity about where we want students to end up as a result of a sequence of learning is fundamental to educational success. Remembering that we cannot reach the mind we do not engage ought to be a daily compass for educational planning.
>
> Tomlinson, 2001, p.1

Assessment denotes to "a process of inquiry that integrates multiple sources of evidence, whether test-based or not, to support an interpretation, decision, or action" (Moss, Girard, & Haniford, 2006, p. 152). It has been assumed as an instrument that has the potential to remould the content, process and structure of education making it responsible for causing distress in current education problems (García & Pearson, 2008). Assessment is deemed important as a proof that learning happens, regardless of students' background, characteristics, and ability per se. The aforementioned quote can be translated that assessment is a powerful tool to determine whether an instructor is engaged with the students' minds and whether students are actually learning. It can be concluded that other than getting evidence that students learned, assessment can benefit the assessor (Nasri, Roslan, Sekuan, Abu Bakar, & Puteh,

2010), namely the instructor, to improve his/her pedagogical qualities and enhance his/her scholarship of teaching and learning.

Besides that, assessment most importantly allows instructors to have a better picture of their learners' abilities as it allows continuous interaction between assessment and instruction (Al-mahrooqi & Denman, 2018). One of most crucial parts of being an educator is to assess the students' performance (Metin, 2011; Letina, 2015) as the impact of assessment for many students with diverse backgrounds is onerous (Janisch, Liu, & Akrofi, 2007) because any mismeasurement of their achievement could harm them (Stiggins, 1995). An alternative assessment is a student-centered approach that focuses on the level of the application of knowledge and skills to real life, taking the individual features of the students into consideration (Çaliskan & Kasikçi, 2010). One of the approaches to alternative assessment, namely differentiated assessment, is the approach put forth in this research to address mixed-ability and diverse learning styles. Differentiation stems from beliefs about differences among learners (Tomlinson, 2001, Lawrence-Brown, 2004, Algozzine & Anderson, 2007), like background, characteristics, learning style, needs, preferences, interests, and abilities. The role of instructor, therefore, has amplified in a multitude of forms to address these diversities. As for students, differentiated assessment gives them the opportunity to choose how they want to be assessed and prove that they have actually learned (NSW Education Standards Authority, n.d., Tomlinson, 2001.) It celebrates students' diversity and acknowledges their mixed learning ability.

2. Literature Review

Conventional assessments have been exclusively monopolised the education for centuries (Bensen, 2013). Paris, Lawton, Turner & Roth (1991) suggest that conventional assessment often dissociate the students into different aspects namely ability and expectations that steer them away into disengagement in learning and thinking, and unable to connect to the real world in terms of applying the gained knowledge. Assessment is supposedly meant for monitoring the students' performance to provide the teachers and students themselves the qualitative information about their cognitive functioning so that they will be able to know better their achievement and teachers can use the information to plan instructions (García & Pearson, 2008) rather than simply comparing their quantitative information such as score or rank (Presseisen, Smey-Richman, & Beyer, 1992) with each other. Race, Brown, and Smith (2005) also believe that assessment in learning should be equitable where students with diverse ability will not be discriminated with only one type of standardised assessment so that the scores from the result will genuinely guide them to make amendment from their mistakes as well as help them to realise how well they are developing as learners.

Janisch et al. (2007) suggest that alternative assessment holds the potential to revoke the students' old behaviour expected from the conservative assessment and rectify the autonomous, self-will as well as their decision to choose. Alternative assessment offers flexible and meaningful learning experiences because students are allowed to experiment their own ideas in order to self-evaluate their own learning styles (Gozuyesil & Tanriseven, 2017). Moreover, teachers are able to construct a motivating learning environment that suits most learning styles as well as create an atmosphere where students' self-assessment of their own learning process (Greenstein, 2010). Therefore, it is crucial to build strong foundation of knowledge about alternative assessment methods and the fundamental theory among the educators (Janisch et al., 2007).

Differentiation is defined as "a philosophy that enables teachers to plan strategically in order to reach the needs of the diverse learners in classrooms today to achieve targeted standards" (Gregory & Chapman, 2007, p.2). Differentiation is a responsive reaction by a teacher to the needs of a learner based on their readiness, interests and learning profile as the concept of differentiation is attending to all the learners' needs rather than simply teach these students with typical pattern albeit they are all fundamentally alike (Tomlinson & Allan, 2000). Differentiated assessment is a continuing assessment throughout the course in order to collect the authentic data of students' achievement for the teachers to plan better strategies in instruction. Normally, differentiated assessment is formative in nature (Koshy, 2013). Teachers who are equipped with classroom practises namely differentiated assessment and instruction will be able to learn more about their students' abilities and then capitalise those strengths as a catalyst to learning (Stefanakis, 2011). Differentiated assessments celebrate students' diverse talents and learning styles by offering mechanisms that give options for them to choose from to suit their

diversity in order to develop their skills (Varsavsky & Rayner, 2013). They also add that flexibility in learning, skills growth and types of measurement items undertaken by students are among the advantages offered by differentiated instruction and assessment. This is because all students have the ability to learn at their own pace and rate as intelligence is not a fixed trait (Presseisen et al., 1992). Furthermore, differentiated assessment also helps the students to cultivate divergent and creative thinking (Brown, Bull, & Pendlebury, 2005).

3. Research in Context

Through this research, a web-based system of an intelligent differentiated assessment system, tentatively named as iPacer, will be developed. This system is customizable at the instructor's end, which means almost any instructor can adopt this system and use it for their own customized and personalized differentiated assessment with their students. Not only this web-based system is faster than the traditional method, it also provides differentiation and produces digitalized outputs that are important for data-driven decision. Examples of output include marks, percentages, analysis of each questions (correct/wrong/out of time), number of clues used, time took to answer questions, and the like. The prototype will be tried and tested on a variety of courses whose instructors are willing to partake on the pilot test voluntarily in UPM. Participants would be undergraduate students enrolled in the selected courses and their respective instructors. Data will be collected both quantitatively and qualitatively in the forms of questionnaire, surveys, interviews, and observations in terms of users' feedback on the system's intelligence module and its graphical design, experience, and the approach for differentiated assessment for alternative assessment. The design of the system will be revisited recursively using the R2D2 design strategy (reflective, recursive, design, develop) until a concrete and robust design has been achieved.

At Universiti Putra Malaysia (UPM), instructors have started to embrace alternative assessment method as one of the means to implement innovative pedagogies in instruction. Alternative assessment can be embedded in pedagogies, be it formatively or summatively. In the spirit of embracing differentiated alternative assessment and optimizing students' heterogeneity and mixed-ability, this research aims at designing a systematic web-based tool tentatively named as iPacer. This tool provides tiered levels of assessments that are appropriate for varied types of students, such that they can demonstrate that they *have learned*, regardless of, and according to, their ability. Impeccably, the development and employment of iPacer will increase awareness of alternative assessment among instructors in UPM, thus, augments UPM's effort to promote alternative assessment implementation. iPacer enables UPM to expand alternative assessment throughout courses and programme across the campus, even if the instructor has little knowledge on this assessment method.

iPacer borrows the elements of differentiated instruction, which provides choice and opportunities for students to get appropriate education in general education classrooms (Lawrence-Brown, 2004) and learn according to their abilities. As compared to traditional assessment or tests, differentiated assessment can benefit students ranging from gifted to those with significant disabilities by providing tiered or multi-level assessment system that will adapt to students' answers and responses. Throughout the assessment, additional supports will be employed such that learners will be given hints like brief clues, strategies, and examples as a support. As alternative assessment does not aim to test what the learners remember, but rather to reveal the comprehension and accomplishment of students (Caliskan & Kasikci, 2010), these features are deemed useful to be embedded in the system. However, these hints are optional, where by learners may or may not choose to use it. If the learners chose to use the hint, a slight deduction of marks will be imposed. An analytics on the number of learners use hint at each question will also be reflected in the analytics, which can be used as a pre-cursor for the instructors to identify topics/concepts that are challenging to the learners.

iPacer provides the flexibility to ease the pressure on middle to low ability learners to genuinely learn and engage in depth with their learning instead of memorizing the information (Llewellyn, 2003), as well as benefit advanced leaners with the opportunities to engage in a more challenging and higher order thinking skills tasks. This will, in return, provide a much accurate insight of students' skills and abilities (Dikli, 2003) and reflects instructors' pedagogical strategies. iPacer will implicitly further support the implementation of smart campus by providing analytics of teaching and learning, and therefore helps instructors nourish students as individual learners.

4. Research Objectives

The main objective of this research is to develop a web-based system of a generic systematic tool for differentiated assessment that can benefit instructors who want to embrace differentiated and alternative assessment, although he/she has little knowledge or 'know-how' on this assessment method. Consequently, this tool can maximize students' potential by giving them the opportunity to take an assessment that suits their ability level. This prototype will be built based on the framework of an ADDIE model and supported by the R2D2 model as a strategy to concretize the design and development of the kit.

5. Research Methodology

This research will be carried out in five phases using the ADDIE Framework. Currently, the research has reached the third phase and is continuously being developed.

5.1 First Phase: Analyze. The first phase involves the needs analysis for the development of iPacer. At this stage, researchers had gathered information on the requirements for the development of iPacer and its modules and user manuals. This had involved several discussions among the researchers and interviewing instructors and learners on the key-characteristics that they deemed as important for the development of iPacer.

5.2 Second Phase: Design. The second phase advanced the data and information gathered from the first phase, whereby the design of iPacer and its modules and user manuals were sketched out. This include the adaptive feature and hints, graphical user interface, buttons and icons, audio visuals, clarity of instruction for users (instructors and learners), analytics, and the like.

5.3 Third Phase: Develop. The third phase focused on the development of iPacer prototype and its modules and user manuals. At this stage, the design of the system were revisited recursively using the R2D2 design strategy (reflective, recursive, design, develop) until a concrete and robust design has been achieved and developed.

5.4 Fourth Phase: Implementation. Pilot test will be conducted at the fourth phase. During the implementation, instructors and their respective students will be able to test-run iPacer and its modules and user manuals. This will be conducted on several courses whose instructor willingly participate in the pilot test, regardless of their knowledge about alternative assessment.

5.5 Fifth Phase: Evaluation. The final phase involves evaluation whereby the researchers will collect feedback from the participants (instructors and learners) in terms of their experience with iPacer, namely the graphical user interface, system, modules and manuals, and the like, in terms of their relative advantage, compatibility, complexity and triability (Rogers, 2003).

6. Anticipated Outcome

The researchers anticipate to have an initial web-based apps of a systematic, intelligent and dedicated tool for alternative assessment tentatively named as iPacer that offers differentiated assessment even for instructors who have little knowledge in this methods but want to embrace it. Additionally, iPacer is a solution that offers analytics that provide an insight into learners' ability level and questions' level of difficulty that can be translated as the concepts that learners' struggle to understand. The development of such prototype corresponds with one of UPM's strategic plan in Putra®Global 200, which aims to achieve international level teaching quality and internationalization. This also echoes UPM's vision to become a university of international repute that produces several progressive innovations.

7. Conclusion

It is hoped that the development of iPacer gives a much greater personalized experience to learners (from gifted to significant disabilities) as they are able to prove that they *have learned*. Learners will be able to proceed with the course of their study in such a way that (i) gifted learners are not delayed in their progress lest the instructor has to cater to the needs of intermediate and low ability learners, and (ii) intermediate and low ability learners are not left behind lest the instructor has to fulfil the needs of gifted learners. The feedback obtained from students will also be beneficial for the future improvements of iPacer and student users. In the perspective of differentiated assessment itself, its affective features that inspire learners to achieve their personal best and take initiative in learning enables students' empowerment. The ability to acknowledge and address learners' mixed ability and made it known to the learners, builds a positive learning environment that leads to learners' satisfaction in learning. Furthermore, the spirit of differentiated assessment that allows for do-overs helps learners to improve and grow over the course of their study. This strategy is the ultimate in designed differentiation.

This research is an evidence that Universiti Putra Malaysia supports the aspirations of the Malaysian Education Ministry to become world's leading education system that actively pursue technologies and innovations that fulfil 21st Century learners' needs as well as enables greater personalization of learning experience. The iPacer offers alternative assessment experience in the form of differentiated assessment both for instructors and learners. This system supports the initiative for smart campus by providing analytics that sheds an insight into the typology of learners that exists in UPM. This research will also shed an insight into the scholarship of teaching and learning, especially in helping instructors to identify learners' learning abilities and ways to nourish individual learners.

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Note

The system is currently being filed for copyright, therefore, images of the system cannot be published at this time until the copyright has been granted.

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WORKSHOP 9 - Teaching Logical Thinking and Programming Language at Different Levels of Instruction