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Evaluating the Effectiveness of Teaching Information Systems Courses: A Rasch Measurement Approach

Abstract

Systems analysis and design (SAND) is an information systems (IS) course that is taught around the world in most higher education management of information systems (MIS) programmes. However, the theoretical nature of this type of course presents challenges for instructors as they devise instructional strategies to convey the abstract concepts that are necessary for their students to understand, such as, how to draw data flow diagrams (DFD) to correctly represent the informational specifications of an IS. Evidence suggests that one of the factors of the low success rates of many IS-design projects in the workforce is due to the graduate recruits' failure to acquire basic SAND knowledge. While a considerable amount of literature focused on integrating technology into the teaching practices to facilitate the knowledge acquisition, a few investigated its effectiveness to fulfil this particular purpose. This paper reflects on such challenges and proposes an evaluation approach to assess the effectiveness of technology integration in teaching an IS course like SAND. The empirical interpretations represented in this paper are gathered through a series of quasi-experimental 2x3 factorial experiments that were conducted at four higher education institutions and based on the Rasch item response theory and measurement analysis. The preliminary analysis from this study provides reliable evidence to delineate key instructional strategies when designing higher education IS courses.

K e y w o r d s: systems analysis and design, courseware design, higher education, Rasch model, instructional design, information communications technology tools

Introduction

Around the world, the undergraduate information systems (IS) course – usually called "Systems Analysis and Design" (SAND) – is taught as a core unit in most higher education Management of Information Systems (MIS) programmes (Topi et al., 2010). SAND provides students with an introduction to fundamental IS-design knowledge and skills for developing high-quality IS. The course has emerged within higher education to accommodate the industry sector's need for informed graduates (Kock, 2006). Since business organisations have been deeply affected by the technological advancements, the sector acknowledges the need for informed IS analysts/developers (Kock, 2006). This view of such professional practice is reflected in how universities design their information technology (IT) courses and other academic programme offerings. However, the Standish Research Group (The Standish Group, 2004) reported students' failure to acquire basic knowledge, concepts, and SAND processes, which was one of the major factors of the low success rates of many IS development projects. In this paper, we are proposing that this failure is in part due to the lack of sound instructional course development pedagogies.

An investigation of the literature has revealed that teaching SAND material was challenging for many reasons. Firstly, due to the theoretical nature of the course content, it is difficult for instructors to engender the students' interest in the course materials (Rob, 2006). In other words, it is not easy to teach a SAND course using hands-on activities like the ones that the students may have already encountered in other IS-related higher education courses, such as programming or database (Rob, 2006). Secondly, it is difficult to teach the course for students who may lack the practical industry sector experience that provides an insight into essential areas covered in SAND (Cybulski & Linden, 2000). Thirdly, it is crucial to ensure that the educational objectives of the course are in line with current industry demands and emerging market trends that reflect the constantly changing nature of technology (Fatima & Abdullah, 2013). However, there have been developments towards improving the instructional strategies that are adopted for SAND instructors have been trying to develop innovative ways to include the disparate knowledge domains required in this course pedagogy. Various approaches and techniques have been used to facilitate the teaching of SAND that include: problem-based learning, project-based role-playing, and group-based techniques. The most recent instructional approaches are web-based learning, educational games, and simulations, which show great potential in improving the SAND pedagogies by providing the industry's experiential user-view. Thus, this pragmatic knowledge-development model was chosen to: generally improve the pedagogies employed to achieve the instructional outcomes, based on a scientific systematic approach; bridge the industry–university gap, between workplace reality and theoretical positions taken by academe; and test the effectiveness of technology enhanced learning to enable the necessary knowledge acquisition and skills development to be correctly monitored. More specifically, this research aimed to investigate the extent of information communications technology (ICT) tools that were used to support the teaching of IS courses and enhance the graduates as they impart this knowledge when they graduate.

This paper describes an on-going doctoral research study and presents its preliminary findings. The following section of this paper presents the proposed prescriptive IS-design model followed by a description of the study's instruments, including the design of the eTutorial module that was used to represent the instructional content used for the experimentation. The next section details the experimental approach adopted for data collection leading to the final section, which briefly describes the key preliminary findings. The paper closes with a conclusion.

The Prescriptive Information Systems Design Model

To facilitate the decision on an effective course delivery mode when teaching SAND, a prescriptive IS-design model was developed drawing on Branson, Rayner, Cox, Furman, & King (1975) instructional design (ID) model. Essentially, it incorporates all core IS-design stages, which involve: analysis, design, development, implementation, and evaluation (Figure 1). We believe that this model proposes a systematic validation procedure conducted to rectify the fidelity of practical aspects during the implementation and evaluation stage. The validation process commences with the plan of the required change in the instructional environment, followed by execution of the methodology, observation of the results, preliminary data analysis, instruments refinement, results-recording, and critical reflection on the subsequent outcomes. This orderly IS-design pattern documents the necessary practical delineations for the effective implementation of the model within the higher education context. Further, it fits well with the growing calls form literature for validating the IS-design models. A critical review of the literature shows the existence of a considerable number of "conceptual" and "procedural" IS-design models, yet only a few studies in this field focus on validating these models (Branch & Kopcha, 2014).

While the proposed model outlines key elements during major instructional stages, we believe that learners' cognitive preference and course delivery mode (see red-boxes in Figure 1) are key variables in the students' learning process, while the interactive effects of these variables on students' performance are largely left as unexplored. Instead, this research explores the interactive effects of these variables and draws on this significance to enhance the IS-design pedagogical practices in higher education.

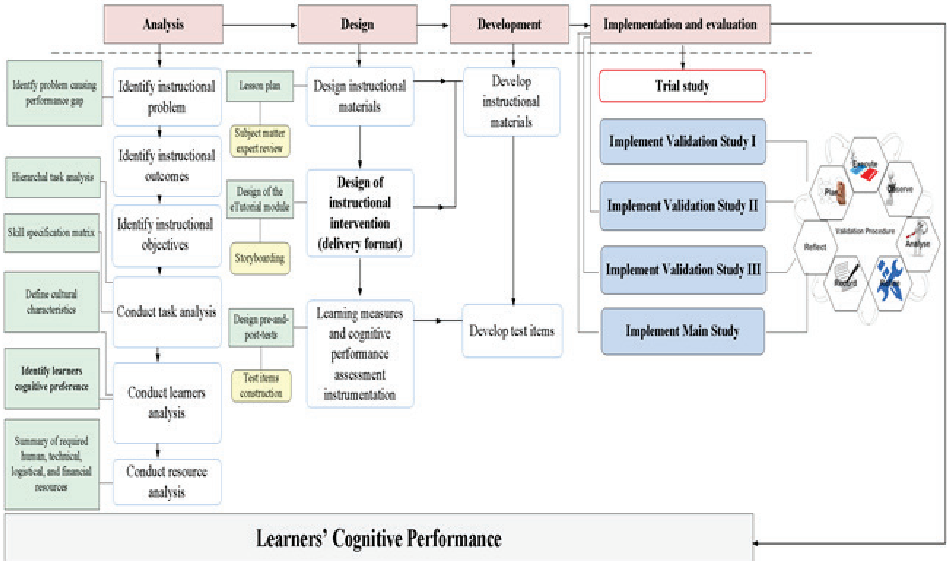


Figure 1. A prescriptive *IS-design model*.

Source: Own work based on Branson et al., 1975.

Course Delivery Mode (CDM)

CDM can be referred to as the process upon which to decide on the presentation of instructional content and the associated tasks and assessments (Porto & Aje, 2004). The continual emerging of new ICT tools impacts the e-learning paradigm thereby causing the evolution of new models and delivery formats in higher education (Nawaz & Kundi, 2010). At this point in time, there is a variety of instructional delivery modes, which include the most commonly applied pedagogies: the conventional classroom model of instructor-led/face-to-face (F-2-F), online/computer enhanced facilitation, and a blended combination of F-2-F and computerised instructional modes. Table 1 summarises the three common CDM and the associated instructional aspects used in this research.

There is a considerable literature that compares the effectiveness or suitability of different instructional/learning environments. Mixed results regarding the effectiveness of CDM have been reported in previous scholarly works. For instance, the online/computerised mode was considered as effective as the conventional F-2-F mode (Kyei-Blankson & Godwyll, 2010), and performance of students in a F-2-F group was better than in the online group (Urtel, 2008). The blended mode has been the focus of many studies in the literature and identified as the most effective delivery format (Kiviniemi, 2014).

However, findings from such analyses were questionable because of the limitations surrounding the measurement approach adopted by the researchers. Much of the research up to now has evaluated learners' academic performance through final course grades or reports, that is, students' raw scores, course completion or withdrawal rates, assessment scores, and students' records, which makes it difficult to draw accurate inferences without precise estimates. And so, this research adopts the Rasch measurement approach to correctly evaluate the cognitive performance offering more accurate measurement outcomes.

Table 1.
The summary of course delivery modes

	Instructional delivery mode/format		
Types of delivery mode	Conventional F-2-F	Computerised/online	Blended/mixed/hybrid
Description	This is the traditional mode, which requires the physical attendance of learners to the classroom. The instructional material is delivered in the form of lectures within scheduled sessions ascribed to the course. Technology is not integrated during instruction.	Physical classroom and/or attendance are not required as the instructional material of the course is delivered electronically. Learners can access the content anywhere and anytime (synchronous/asynchronous modes). There is a complete reliance on technology (ICT tools) to convey learning/instruction.	This delivery mode combines elements from the traditional F-2-F and computerised/online modes. The use of ICT tools is mainly to support the instruction during the F-2-F mode.
Knowledge is	received	constructed	acquired
Technology use is	not essential	essential	recommended
Learning is	passive	self-paced	directed
The role of instructor is	a transformer of knowledge	a facilitator	a guide (a player)
The role of learner is	a receiver of knowledge	a constructor of knowledge	a player
The goal of teaching is	to prepare informative learners	to prepare competent learners	to prepare qualified learners
Instructional content is presented as	texts	texts, pictures, diagrams, games, audio, and video (animation)	texts, pictures, diagrams, games, audio, and video (animation)
The forms of teaching are	lectures, tutorials, or seminars	eTutorials, eModules, online-lectures, eSeminars	the mixture of traditional and online lectures, eTutotials and F-2-F seminars

Source: Own work.

Learners' Cognitive Preference

This research adopted Riding and Rayner's (1998) definition of the cognitive style construct, which can be referred to as the learner's preferred approach towards their information processing style. Up to now, the educational technology literature has tended to focus on the significance of learners' cognitive style/preference in relation to their academic performance when designing for higher education (Zhang, 2004). For example, a plethora of studies (for instance Boyle, Duffy, & Dunleavy, 2003; Thomas & McKay, 2010) investigated the matching claim that assumed an enhanced performance if instruction match learners' cognitive styles. Rayner and Cools (2011) suggested that when students use their preferred learning styles, they will learn more effectively because they are more engaged in the learning process. The multidimensional model of Riding and Cheema (1991) measured an individual's cognitive preference based on two cognitive dimensions: Wholist-Analytic (W-A), and Verbal-Imagery (V-I) (Figure 2). While the W-A dimension assesses how individuals prefer to process information (in wholes or in parts), the V-I dimension measures how the individual prefers to represent information during thinking (in a verbal or imagery form). The Cognitive Style Analysis (CSA) test is a computerised assessment tool developed by Riding and Cheema (1991) that has been used in this study to identify participants' cognitive preference.

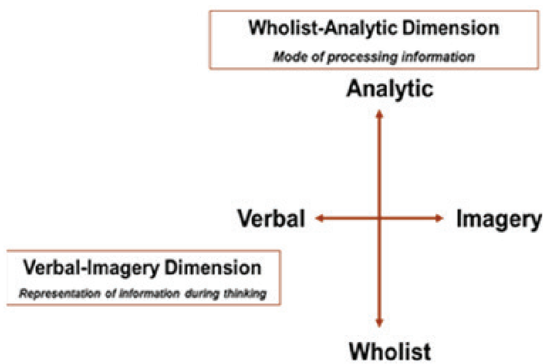


Figure 2. The cognitive style dimensions.

Source: Riding and Cheema, 1991.

Research Study Instruments

Prior to the design of the eTutorial module, sound ID activities underpinned the construction of the instructional content, including: the development of a thorough task analysis, a targeted lesson plan, and a skills development matrix. Table 2 shows the skills development matrix that was constructed based on the Gagné learning domains (Gagné, 1985) and used to design the tutorial tasks and the cognitive performance/assessment tests. Tasks were plotted across the matrix based on difficulty, starting from the easiest skills moving to more complex ones. The matrix also shows the types of skill development tasks (in this case with either dichotomous or partial credit models) that were involved in the assessment instruments/tests. The skills development matrix was created to ensure that we had enough questions to measure the acquisition of the required knowledge and establish meaningful evidence to make reliable probabilistic inferences.

Table 2.
Skills development matrix (adapted from McKay, 2000)

DFD set development		Instructional objectives: DFD set development					
		Declarative		Procedural			
		Band-A	Band-B	Band-C	Band-D	Band-E	
		Verbal information skill concrete concepts; knows basic terms; knows 'that'	Intellectual skill basic rules; discriminates; understands concepts & principles	Intellectual skill higher order rules; problem solving; applies concepts & principles to new situations	Cognitive strategy identifies subtasks; recognises unstated assumptions	Cognitive strategy knows 'how'; recalls simple prerequisite rules & concepts; integrates learning from different areas into a plan for solving a problem	
Task No.	Learning domain						Task difficulty
5	DFD set development						difficult
4	DFD validation check						medium-to-difficult
3	DFD set classification						medium
2	Understanding of different levels of DFD's set						easy-to-medium
1	DFD symbols / notations understanding						easy

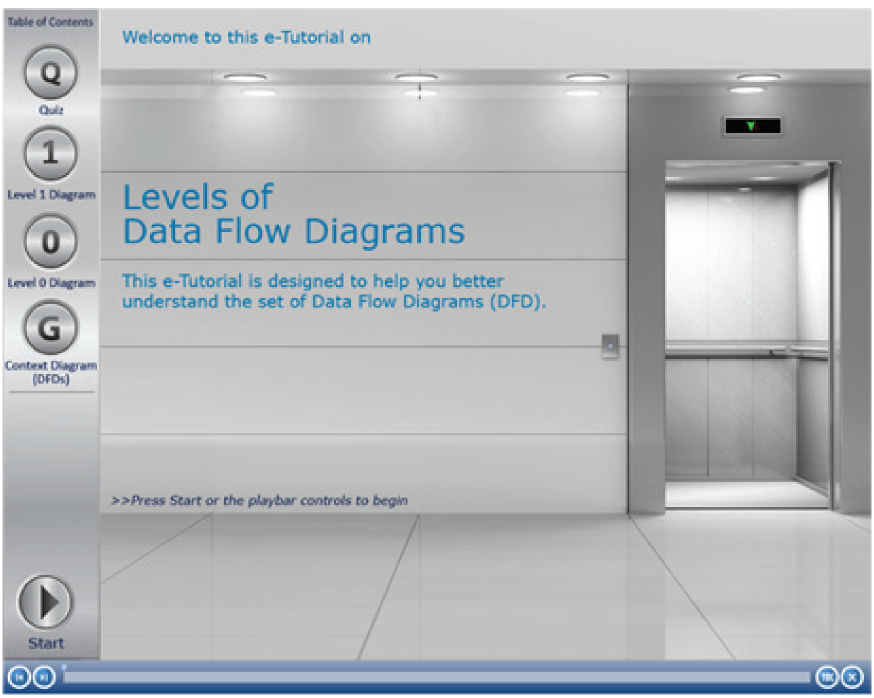
S o u r c e: Own work.

The resulting main assessment instruments were the pre-and-post-tests that were constructed following a systematic approach (Izard, 2005). Participants' raw scores were converted by the researcher into numeric values to align with the data analysis software tool QUEST interactive test analysis system, designed and built by Adams and Khoo (1996).

The Design of the eTutorial Module

The IS-design storyboarding activity was conducted to enable the web developer to build the online instructional module to meet IS-design specifications.

Some of the interactivity features were included to accommodate the needs of learners who have various cognitive preferences when receiving their instruction. For instance, the module commenced with a "welcoming page" (Figure 3) to introduce learners to the topic through the conceptualisation of the set of data flow diagrams (DFD) that reflected the concept of a multi-levelled building. An instructional page followed to inform users on the interactivity features that were available for use when they took the instructional module at their own pace (Knowlton and Simms, 2010). Two navigation bars were located on the computer screen in two positions: one located in the navigation bar at the bottom of the screen to allow smooth movement between the different module parts, and a general knowledge navigator button located at the left-side of the computer-screen to enable users to repeat a particular task or to choose certain other parts of a particular module. Further, the instructional materials were presented in the forms of: screen-based textual blocks; diagrams and pictures; and a combination of both, to suit the preference diversity of the learners who may prefer to receive their instructional materials in these various modes during their thinking (Figure 3). Colours were also used to highlight critical parts of the system to provide learners with some support with the structure, should they need this.



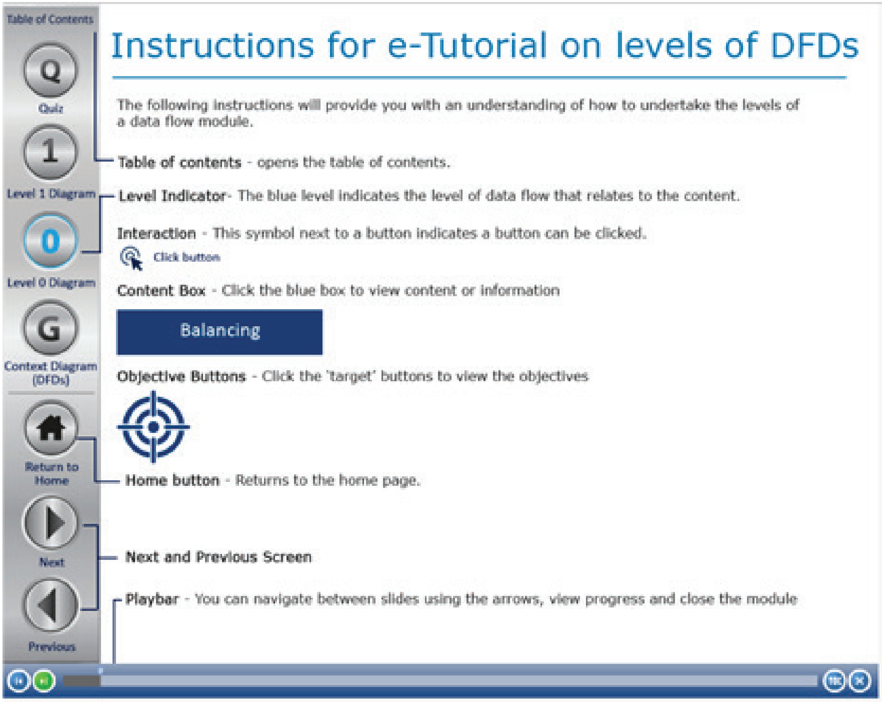


Table of Contents
Quiz
Level 1 Diagram
Level 0 Diagram
Context Diagram (DFDs)
Return to Home
Next
Previous
Instructions for e-Tutorial on levels of DFDs
The following instructions will provide you with an understanding of how to undertake the levels of a data flow module.
Table of contents - opens the table of contents.
Level Indicator- The blue level indicates the level of data flow that relates to the content.
Interaction - This symbol next to a button indicates a button can be clicked.
Click button
Content Box - Click the blue box to view content or information
Balancing
Objective Buttons - Click the 'target' buttons to view the objectives
Home button - Returns to the home page.
Next and Previous Screen
Playbar - You can navigate between slides using the arrows, view progress and close the module

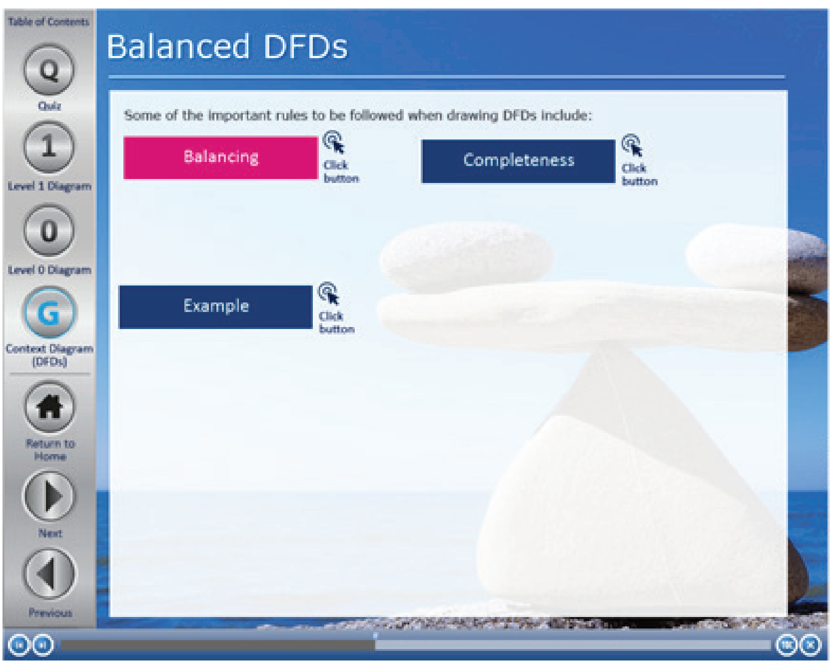


Table of Contents
Quiz
Level 1 Diagram
Level 0 Diagram
Context Diagram (DFDs)
Return to Home
Next
Previous
Balanced DFDs
Some of the important rules to be followed when drawing DFDs include:
Balancing
Click button
Completeness
Click button
Example
Click button

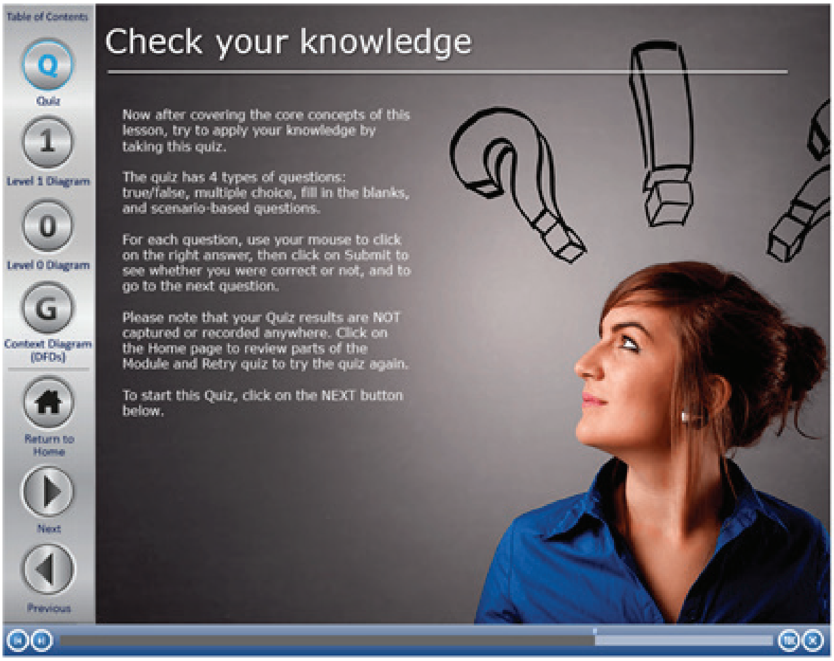


Figure 3. Screenshots of the eTutorial module.

Source: Own work.

The Experimental Procedure

A series of 2x3 factorial quasi experiments were conducted at four higher education institutions during different phases of this research project. A total of 167 undergraduates voluntarily participated in this study. The experiments were carefully planned to include four separate main experimental steps (Figure 4). The pre-test was a key activity during the first step, which aimed to assess participants' DFD knowledge prior to the intervention, followed by the random allocation by the researcher of the participants into one of three instructional environments: Treatment 1 (T1) – instructor-led/face-to-face (F-2-F), Treatment 2 (T2) – online/computer enhanced facilitation, and Treatment 3 (T3) – a blended combination of F-2-F and computerised instructional modes. The third step was the instructional intervention, where each group received their allocated instructional treatment. The final step was the post-test which aimed to measure participants' knowledge change after the intervention.

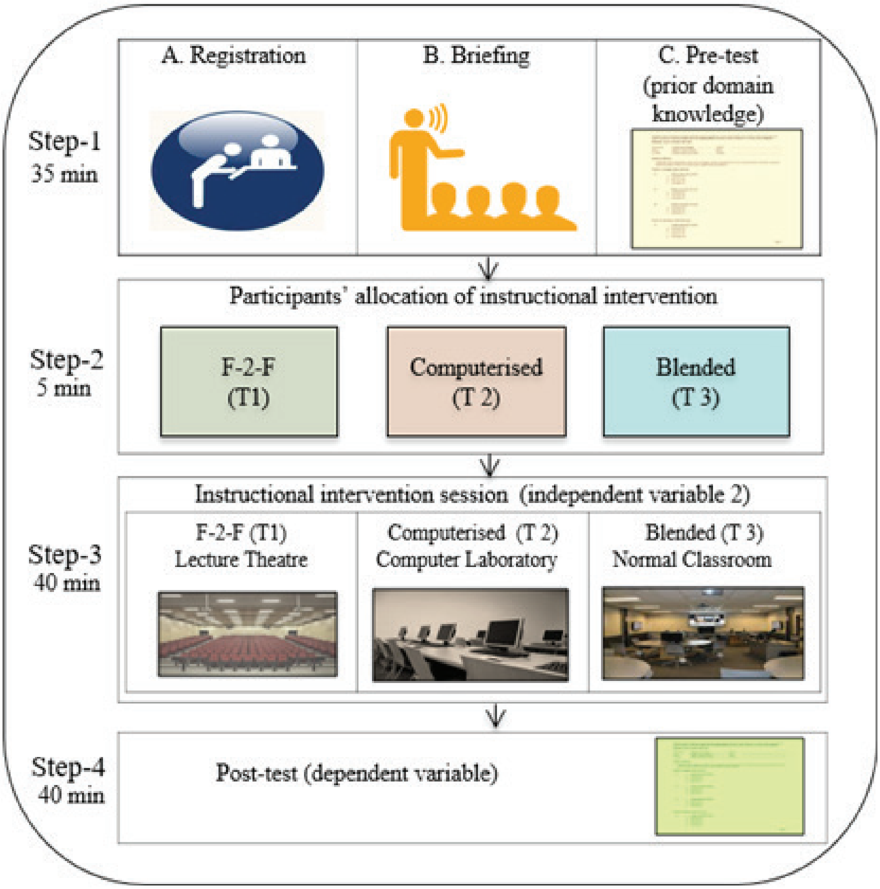


Figure 4. The experimental procedure.

Source: Own work.

Preliminary Findings

Because declaring the full data analysis for this research project is beyond the scope of this paper, the following section will present only preliminary key findings thus far from the main experiment study which involved 41 participants. The findings will be presented in two sections. The first part shows the results of the CSA test used for the allocation of participants into one of the three instructional treatments: T1 the conventional face-to-face classroom mode, T2 the computerised mode, and T3 the blended mode. The second section describes the validity of the testing instrumentation followed by the cognitive performance evaluation. Results were analysed using the QUEST Interactive Test Analysis Software that was developed by Adams and Khoo (1996) based on the Rasch model and the Item Response Theory (IRT).

The Cognitive Style Analysis Test (CSA)

Riding and Cheema's (1991) CSA test results were used to randomly allocate participants into one of the three course delivery modes. Figure 5 is an illustration of this participant allocation process whereby their CSA outcome was labelled as: blue triangles for receiving T1, green diamonds for receiving T2, and red squares for T3.

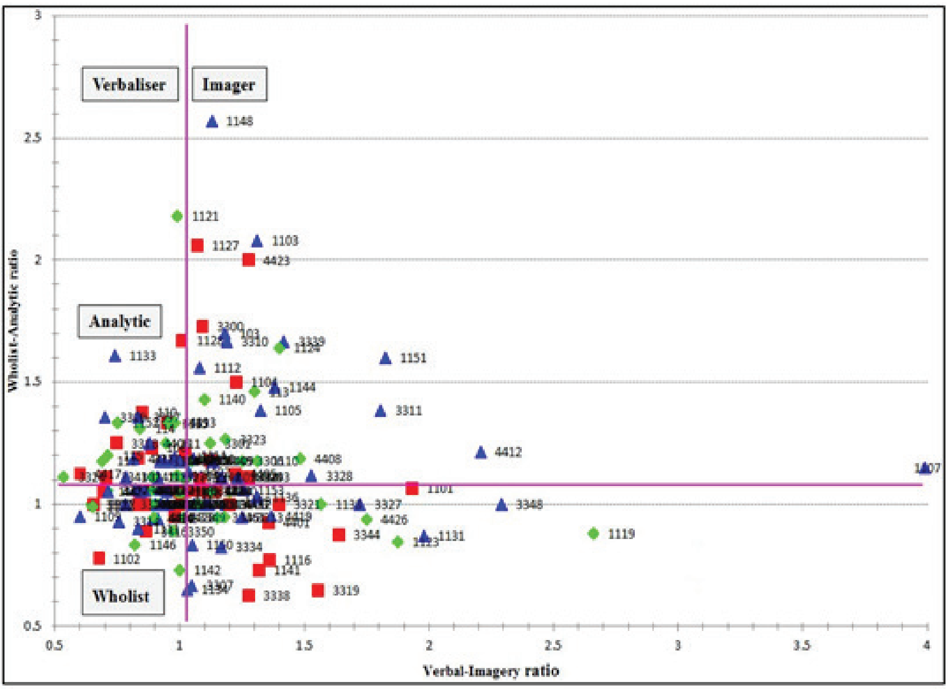


Figure 5. Allocation of participants to instructional treatment.

Source: Own work.

Performance Evaluation

The statistical performance of test-items

The QUEST item fit map (Table 3) was used to provide a visual representation of the magnitude of the fit statistic of test-items that were conforming to the Rasch requirements. Each question was represented by a star sign and needs to lie between the dotted lines (thresholds) which define the acceptable (Rasch model) range of test-items. Table 3 (a & b) show the preliminary validation for test-items. So, all test-items outside the thresholds in Table 3a were misfit items, as they behaved inconsistently compared to the other test-items, and therefore were deleted from the analysis (Table 3b). A total of 10-test-item deletion runs were conducted to ensure that all items were a fit to the Rasch model (Table 3b); this process was vital to ensure that all test-items were valid and reliable for further analysis.

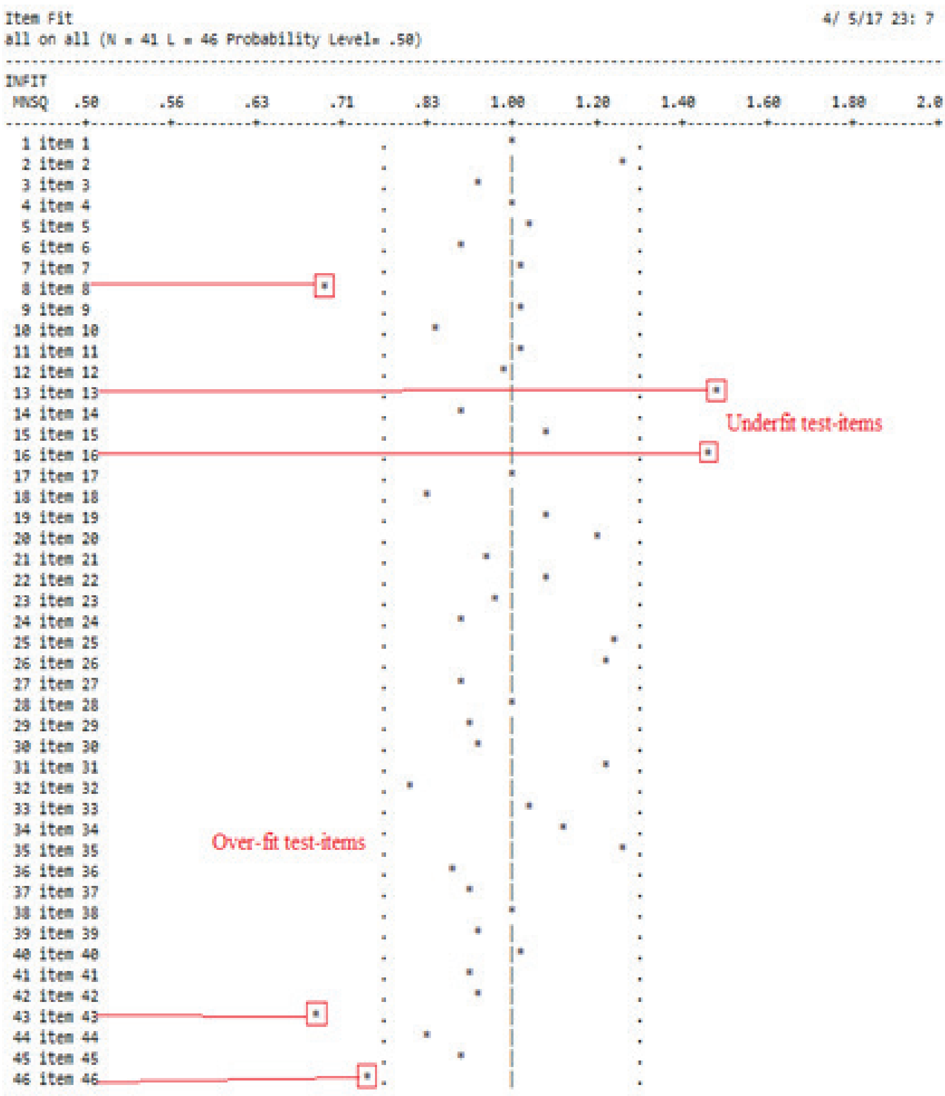


Figure 6a. An item fit map (pre-test misfit items).

Source: Own work.

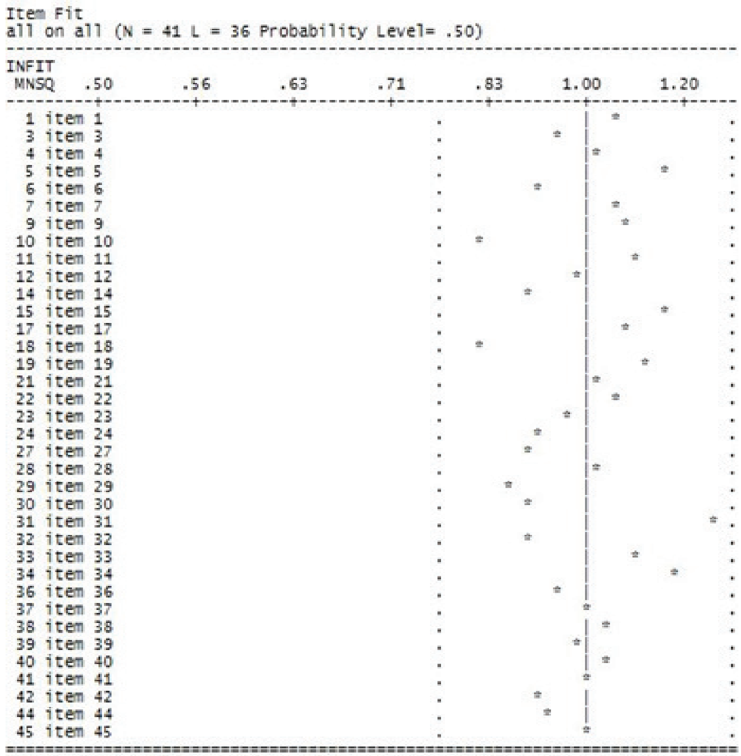


Figure 6b. An item fit map (pre-test misfit items).

Source: Own work.

The performance of test-items in relation to participants

The QUEST variable map enables the performance evaluation of both test-items and participants on the same unidirectional logit scale. For instance, Figure 6 (a & b) shows variable maps of the pre-and-post-tests from the main study; each X on the left side of each map represents one participant, who is plotted on the logit scale based on his or her ability. Consequently, the low performers are positioned at the bottom of the scale and high performers at the top. All the numbers on the right side of each map depict the test-items that were plotted by the QUEST estimate, based on their level of difficulty, with the easiest placed on the logit scale at the bottom escalating to the hardest at the top. The figures below show that participants performed better in the post-test than in the pre-test. The performance distribution in the pre-test was slightly above -1.0 and 3.0 logits; however, it shifted to lie between -1.0 and above the 4.0 logit value. The shift in the distribution may have resulted from the instructional intervention affecting participants' performance.

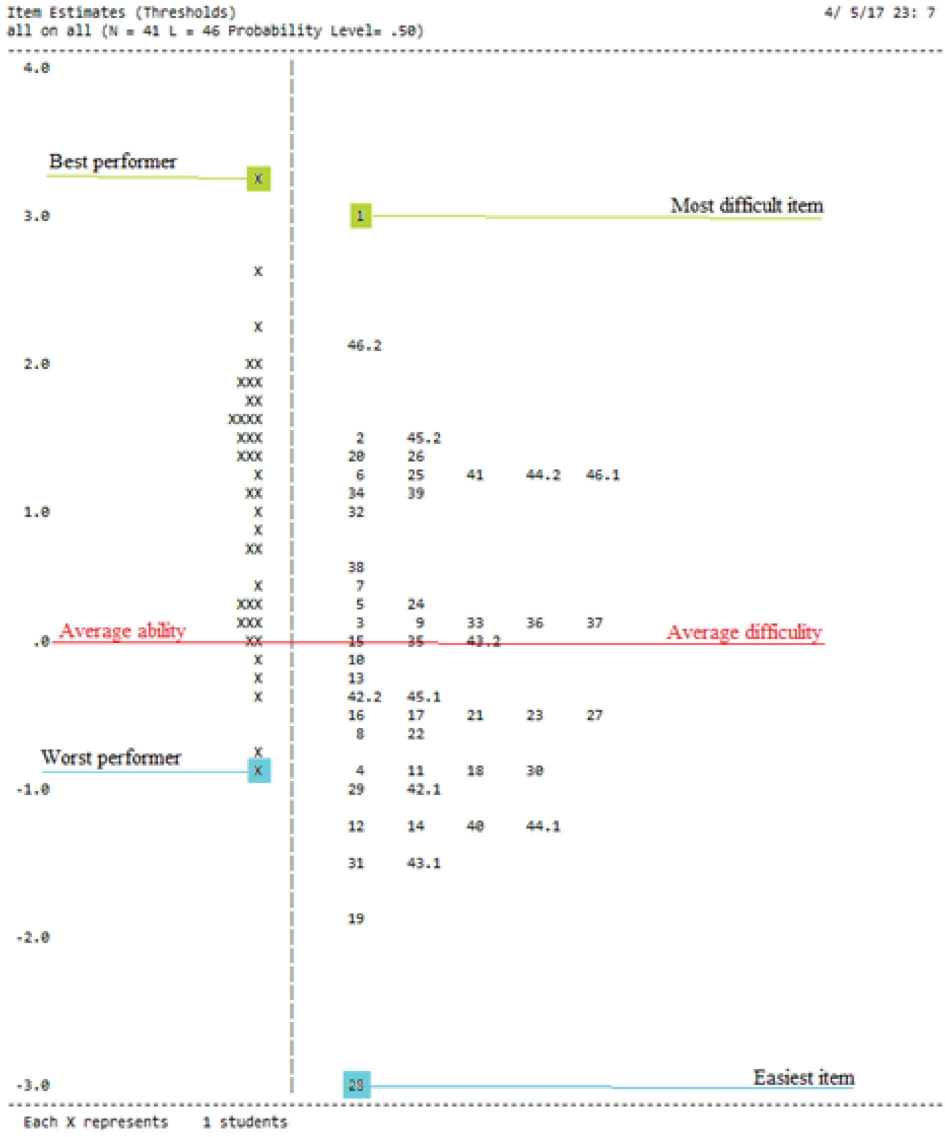


Figure 7a. A variable map of pre-test.

S o u r c e : Own work.

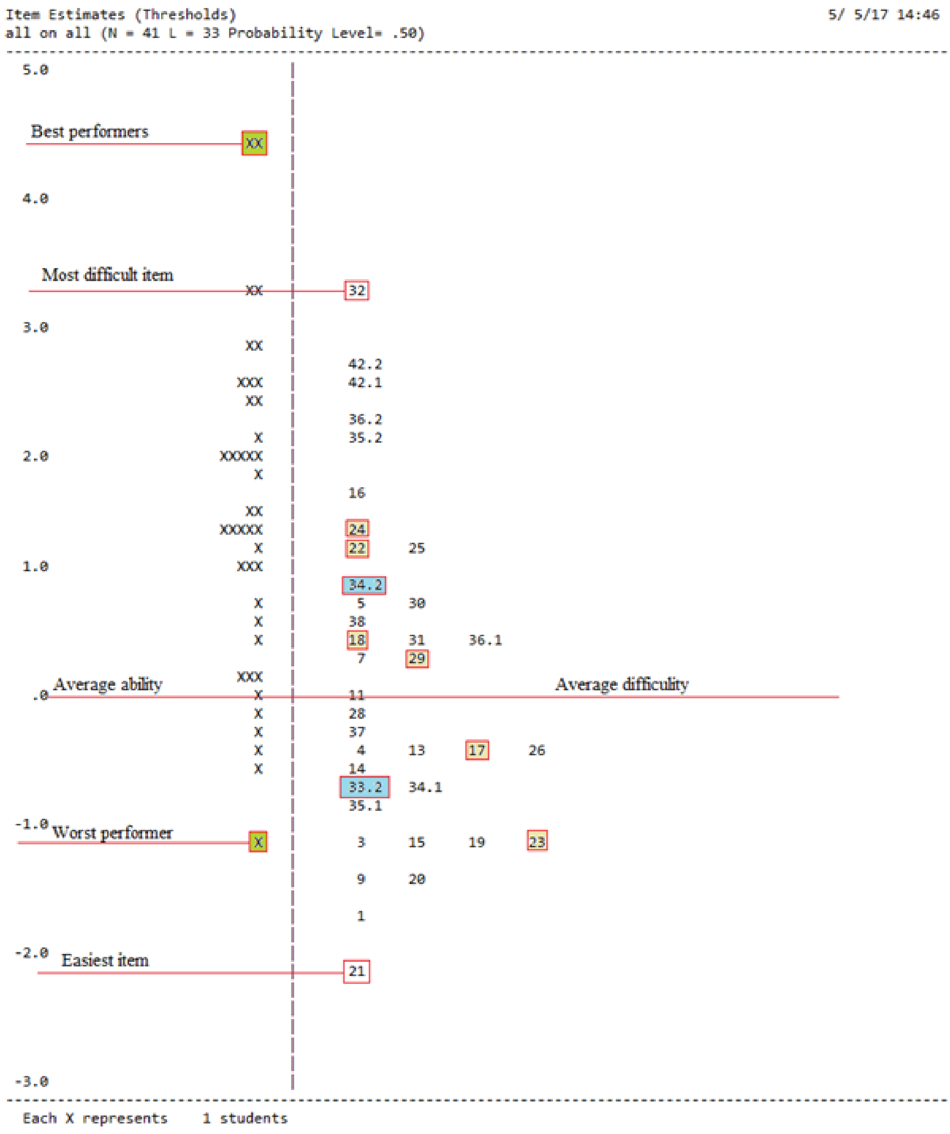


Figure 7b. A variable map of post-test.

S o u r c e : Own work.

Participant's cognitive performance

Further analysis of other QUEST estimate outputs (such as the kid-maps), revealed fine-grained details regarding the performance of each participant. Figure 7 is such a kid-map example that depicted a participant from the blended environment.

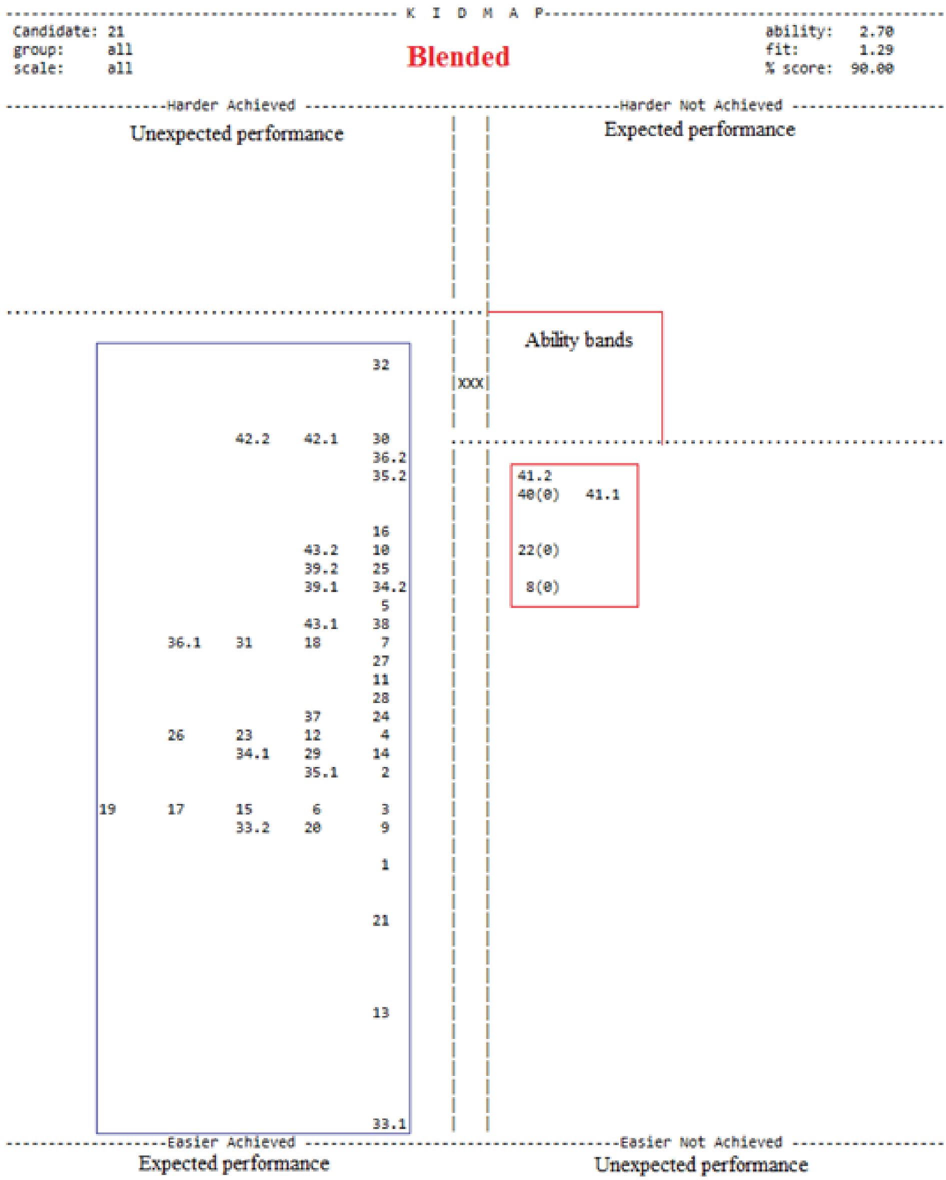


Figure 8. A QUEST kid map for one participant.

Source: Own work.

These kid-maps provided an estimated ability for a selected participant along with test-items expected to be achieved and not achieved by the participant. For example, the ability band of the participant shown in Figure 7 is defined between the dotted lines. All test items on the left side of the map were successfully achieved by the participant (including the ones easier and harder to achieve), whereas the participant was not able to answer test-items located on the right side (including the ones easier and harder to achieve). This output enables fair evaluation and comparisons of cognitive performance variation of participants who received instruction from three different course delivery modes. For instance, in terms of task difficulties and performance, results show that all participants easily acquired declarative knowledge (knowledge that requires a learner's lower level skills) under the three experimental instructional modes. The computerised mode (the technology-enhanced T2) facilitates the knowledge required to answer tasks with a medium-difficulty level. However, the blended environment (T3, a combination of both instructional modes) enables the acquisition of procedural knowledge (knowledge that requires a learner's higher-level procedural skills). Thus, the design aspects of the blended mode may have contributed to the finding that the blended instructional strategy is the most effective course delivery mode for an IS course that has a strongly theoretical nature and abstract concepts such as the SAND. The specifications of the blended learning in this study involved a face-to-face collaborative students' instruction combined with an off-line eTutorial module. Accordingly, we can find several key issues for consideration in terms of the pragmatic implications for technology implementation under the computerised and blended environment. The design of the instructional content needs to be aligned with the availability of time and budget, and most importantly the learners' cognitive style. Balancing content, time, and budget was challenging to accommodate various learners' styles and deliver successful programmes. Thus, another key factor was to match the best course delivery mode necessary to achieve the instructional objectives. This does not imply the priority or popularity of one delivery mode over another, but simply the employment of the effective mode to positively interact with the learners' style and to facilitate knowledge acquisition. However, the type of knowledge acquisition varies with the complexity of its associated skill development requirements. And so, this study attempts to empirically validate the performance of participants with a gradual knowledge acquisition approach. It has been suggested that effective engagement and interactivity are two critical elements when designing for a computerised and blended environment. For successful learning, learners are required to be engaged and interact with other learners and an instructor. However, to achieve such a challenge, the pedagogy design may necessitate some off-line activities or instruction to ensure learners' involvement. Unlike the common view of the digitised instructional environment, the design specifications for computerised or blended pedagogy may require some aspects of the instructional content to be de-digitised for the purpose of matching learners' preferred instructional/learning style and subsequent delivery modes.

Conclusion

This paper has examined some of the issues surrounding the challenging pedagogical tasks of teaching an IS course in the higher education sector. The proposed prescriptive IS-design model was motivated by sound ID principles to lay the foundation of accurate performance measurement that verified the effectiveness of the ePedagogical practices involved. The careful design of the eTutorial module and the experimental procedure facilitated learners' engagement in their learning process. The adoption of the Rasch measurement model in analysing these results allowed the evaluation and comparisons of accurate statistical probabilistic inferences regarding the effectiveness of the integrate ICTs in the course delivery mode. The preliminary analysis presented in this paper highlights the key finding of the effectiveness of the blended environment and supports the decision of its validity to deliver a higher education IS course that involves theoretical and abstract concepts similar to SAND. Bearing in mind the small sample size of participants in this study, caution must be applied when interpreting such preliminary findings as they may not be applicable in other educational contexts.

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Ocena efektywności kursu Systemy Informacyjne – wykorzystanie modelu Rascha

Streszczenie

Analiza i projektowanie systemów jest kursem poświęconym systemom informacyjnym, znajdującym się w programie nauczania większości studiów dotyczących zarządzania systemami informacyjnymi. Natura teoretyczna tego typu przedmiotu stanowi wyzwanie dla nauczycieli, gdyż muszą oni wymyślić strategie pozwalające studentom zrozumieć pojęcia abstrakcyjne, takie jak na przykład diagramy przepływu danych oraz poprawne specyfikacje systemu informacyjnego. Badania wskazują, że jednym z czynników wpływających na niską jakość wielu projektów z zakresu analizy i projektowania systemów, przygotowanych przez pracowników zatrudnionych tuż po ukończeniu studiów, jest brak podstawowej wiedzy z tej dziedziny. Chociaż w literaturze przedmiotu dużo uwagi poświęca się sposobom wykorzystania różnych technologii w procesie nauczania w celu ułatwienia akwizycji wiedzy, tylko nieliczni badacze zajmują się jednak efektywnością takiej integracji. W niniejszym artykule przedstawiona została refleksja nad takimi próbami. Zaproponowane zostało również podejście umożliwiające ocenę efektywności włączenia technologii do nauczania takiego przedmiotu jak analiza i projektowanie systemów. Zaprezentowane wyniki empiryczne zostały zebrane podczas serii quasi-eksperymentalnych kategorialnych badań 2x3, które zostały przeprowadzone w czterech uczelniach wyższych. Do ich interpretacji użyto modelu IRT Rascha. Wstępna analiza dostarcza dowodów dla możliwości określenia kluczowych strategii potrzebnych do opracowania kursu na temat systemów informacyjnych.

Słowa kluczowe: analiza i projektowanie systemów, projektowanie kursów, nauczanie na uczelni wyższej, model Rascha, scenariusz zajęć, technologie informacyjne i komunikacyjne

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Оценка эффективности курсов обучения информационным системам: измерение по модели Раша

Аннотация

Системный анализ и проектирование - это курс из области информационных систем, который преподается во всем мире в большинстве программ высшего образования по управлению информационными системами. Однако теоретический характер этого типа курса представляет проблемы для инструкторов, поскольку они разрабатывают учебные стратегии для передачи абстрактных понятий, которые необходимы их ученикам для понимания, например, как рисовать диаграммы потоков данных, чтобы правильно представлять информационные спецификации. Данные свидетельствуют о том, что один из факторов низких показателей успеха многих проектов дизайна информационных систем в деятельности сотрудников связан с тем, что выпускники не приобрели базовые знания системного анализа и дизайна. Хотя значительное количество литературы сосредоточено на интеграции технологий в практику преподавания для облегчения приобретения знаний, но мало исследована их эффективность для достижения этой конкретной цели. В настоящей статье отражены такие проблемы и предлагается подход к оценке эффективности интеграции технологий при преподавании курса дизайн информационных систем, например, системного анализа и дизайна. Эмпирические интерпретации, представленные в этой статье, собраны в виде серии квази-экспериментальных фактографических экспериментов 2x3, которые были проведены в четырех учреждениях высшего образования и основаны на применении метода Раша и анализе измерений. Предварительный анализ предоставляет надежные данные для определения ключевых учебных стратегий при проектировании курсов.

Ключевые слова: системный анализ и проектирование, дизайн учебных программ, высшее образование, модель Раша, учебный дизайн, инструменты информационных и коммуникационных технологий

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Evaluando la efectividad de la enseñanza de información

Resumen

El análisis y diseño de sistemas (SAND) es un curso de sistemas de información (IS) que se enseña en todo el mundo en la mayoría de los programas de gestión de sistemas de información (MIS) de educación superior (HE). Sin embargo, la naturaleza teórica de este tipo de curso presenta desafíos para los instructores a medida que diseñan estrategias de instrucción para transmitir los conceptos abstractos que son necesarios para que los estudiantes entiendan conceptos como: cómo dibujar diagramas de flujo de datos (DFD) para representar correctamente el especificaciones de un IS. La evidencia sugiere que uno de los factores de las bajas tasas de éxito de muchos proyectos de diseño IS se debe a que los formandos no adquirieron conocimientos básicos de SAND. Si bien una cantidad considerable de literatura se centró en la integración de la tecnología en las prácticas de enseñanza para facilitar la adquisición de conocimiento, algunos investigaron su eficacia para cumplir con este propósito particular. Este documento reflexiona sobre estos desafíos y propone un enfoque de evaluación para evaluar la efectividad de la integración de la tecnología en la enseñanza de un curso de IS como SAND. Las interpretaciones empíricas representadas en este documento se recopilan a través de una serie de experimentos factoriales casi experimentales de 2x3 que se realizaron en cuatro instituciones de educación superior y se basaron en la teoría de respuesta de ítems de Rasch y en el análisis de medidas. El análisis preliminar de este estudio proporciona evidencia confiable para delinear estrategias de instrucción clave al diseñar cursos IS.

Palabras clave: análisis y diseño de sistemas, diseño de cursos, educación superior, Modelo Rasch, diseño instruccional, herramientas de tecnología de la información y la comunicación