When considering learning processes and educational designs today, it is necessary to consider and navigate from a double perspective which both adheres to society’s demands and to the technological developments within learning. On the one hand, society’s demand for learning and the change of contexts in which learning takes place influence the expectations from elearning technologies, but it is also the case that technological development challenges human practices such as pedagogy, teacher and student roles, and people’s conceptualization of learning and knowledge. Therefore, innovation, development and adaption from both sides of human-technology-interaction have become ongoing issues. The articles in this issue take different approaches to explore this widening range of possibilities for elearning and offers complementary views into the possibilities through technological experimental work with algorithms in the laboratory, two studies of actual users in real learning settings and their encounter with technology and learning, as well as a survey that compares students from different national and cultural backgrounds. While the laboratory study has not yet reached the point of considering the use of real users, the empirical work finds that both human and technological issues are of importance for further development of elearning.

Sabitha, Mehrotra and Bansal take their point of departure with the claim that in order to achieve holistic learning, knowledge enriched teaching skills are required, which can enhance and increase the thinking skills of the learner to a higher level. Their research argues that present day Learning Management Systems (LMS) do not meet this demand as their development and design primarily addresses ease of use, search facilities, content and performance. According to the authors, knowledge should also be delivered along with the domain information and in the paper they propose the idea of an enhanced Learning Object (LO) called Knowledge Driven Learning Object (KDLO) aimed at delivering better learning to the user. According to their experiment that tests developed algorithms, users queries for learning material in courses resulted in KOs that are associated with relevant LOs. In the conclusion the authors point to the need to study other approaches that justify the need of the user.

Tarhini, Scott, Sharma and Abbasi finds that the use of Really Simple Syndication (RSS) offers a means for university students to receive timely updates from virtual learning environments. However, a survey at a university in the Lebanon shows that despite the assumed utility of RSS, only 21% of home students claim to have ever used the technology. In order to investigate whether national culture could be an influence on the intention to use RSS, the survey was therefore extended to British students in the UK and explored the students’ attitude towards behavioral intention to use; attitude towards benefit; perceived usefulness; and perceived ease of use. Although there were a higher percentage of users in the UK, the picture appeared similar to that of the Lebanese students. The study also found significant differences between perceived usefulness and perceived ease of use across the two contexts studied, and that it is not clear whether educational technology that has been developed in one location will be perceived in a similar way in a
different location. Therefore future research should examine potential moderators which may influence these variables and their relationships in other learning contexts.

Tarhini, Hassouna, Abbasi and Orozco points at the dilemma faced by higher educational technology and engineering disciplines between resources and the focus on pedagogy and instructional designs that emphasize peer instruction and rich formative feedback. They also point at the challenge to maintain student engagement outside the traditional classroom environment and ensure that students receive feedback in time to help them with ongoing assignments. The authors see that virtual learning platforms and web feed syndication such as Rich Site Summaries (RSS) can help institutions to overcome such challenges. However, an initial pilot at an institution in the Lebanon showed that only one fifth of students used the facilities. In the current study the Technology Acceptance Model (TAM) was used to guide the development of a scale to be used to investigate antecedents to the use of web feeds. The results revealed adequate face, content, and construct validity. Thus RSS feeds in education were found to significantly improve the content presented by the instructors to the e-learning user. However, perceived ease of use was not a significant predictor of attitude towards use. This suggests that aspects of the model may lack criteria validity in the Lebanese context. Consequently, it may be necessary to extend the scale to capture cultural values and subjective norms. In the discussion the authors point at the limited scale of the study and suggest that longitudinal studies be employed in future research along with the inclusion of diverse theoretical models and diverse antecedents. According to the authors this will provide more insight into the phenomena of adoption and usage of technology.

Mettäinen aimed at studying nursing teachers’ and students’ attitudes to and experiences of using an electronic assessment and feedback tool (eTaitava) in the supervision of clinical training, during a real setting pilot project. Nursing teachers participated in interviews and a survey while students responded to the survey. The study found that four-fifths of the students responded to teacher produced questions via eTaitava almost daily and found the software easy to use. Based on the students’ and teachers’ experiences, the use of the electronic assessment and feedback tool showed that electronic assessment and feedback can make it possible for teachers and students to promote learning during clinical training by challenging students to reflect on their learning experiences. The findings of the pilot study were encouraging, and indicate that the method is worth further development and will be potentially useful in supervision in all fields of education. However, attention should be paid to the software features, such as user-friendliness, in the introduction of the programme.

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Knowledge Enriched Learning by Converging Knowledge Object & Learning Object

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Abstract: The most important dimension of learning is the content, and a Learning Management System (LMS) suffices this to a certain extent. The present day LMS are designed to primarily address issues like ease of use, search, content and performance. Many surveys had been conducted to identify the essential features required for the improvement of LMS, which includes flexibility and a user centric approach. These features can suffice the need of all learners, when they have different learning requirements. For a true learning, knowledge should also be delivered along with the domain information. There is a need to design an architecture for user centric Knowledge Driven Learning Management System (KDLM). Thus, for holistic learning, knowledge enriched teaching skills are required, which can enhance and increase the thinking skills of the learner to a higher level. The current LMS needs an improvement in the direction of knowledge discovery, exploration so that knowledge enriched learning can be provided to the learner. It can be based on knowledge engineering principles like ontology, semantic relationship between objects, cognitive approach and data mining techniques. In this paper, we are proposing an idea of an enhanced Learning Object (LO) called Knowledge Driven Learning Object (KDLO), which can be delivered to the user for better learning. We had used a data mining approach, classification to harness, exploit and classify these objects according to their metadata, thereby strengthening the content of objects delivered through the LMS.

Keywords: LMS; KMS; Learning Object; Knowledge Object; Classification; Decision Tree; Knowledge Driven Learning Objects; Knowledge Driven Learning Management System; e-Learning.

1. Introduction
At the beginning of 2001, the major issues that e-Learning communities were facing are resource sharing, repurposing, and inter operation between different e-Learning systems. These issues led to the growth of two kinds of e-Learning systems, LMS and Learning Content Management System (LCMS).

LMS is a high-level strategic solution that handles all aspects of the Learning Process and a portal for collaborative learning (Greenberg 2002). LCMS is primarily used for management of Learning Contents. It has elements like an authoring and assembly tool for creating Learning Objects, a repository for storing them and a dynamic engine for delivering Learning Content to the learners. The development of LCMS can be considered as a great progress for e-Learning environment, where technology of creating and maintaining Learning Objects was standardized. Till, here the Learning Object is considered as a core concept of Learning Content and thus LMS were mainly informatics centric rather than knowledge centric.

According to Experts & Training Industry (2010), LMS also plays a pivotal role in all business domains. The current LMS and LCMS were developed basically for the delivery of study materials, but today there is a need to develop an environment that helps instructors and students in value added teaching/learning, with a focus on what students need to know. The LMS should also support a situation where the learner has some preferred Learning Style (Graf & Liu 2008). Definitely, there is a need of wider metadata so that learners can select the content as per his choice. These issues were resolved to an extent by developing an LMS based on web 2.0, which helps in collaborative learning and creation of dynamic digital repositories. These Learning Systems have built-in collaboration tools (Blogs, wiki), which provide a space for learners to interact, share and learn through mutual collaboration. Many of them also provide tools for interaction with instructors, mentors and peers via a discussion forum, chat and virtual communities.

Today the K-economy is the buzzword frequently used by the people from all the domain of business. This has shifted from product based economy to a knowledge-based economy resulting in an increased demand for the workers who are capable of higher-order thinking and reasoning in solving intricate and authenticate problem
in the workplace. All leading business organizations are now working on the principle of knowledge management where knowledge of its people is considered the most valuable resource of the organization. Knowledge Management (KM) is essentially about facilitating the processes by which knowledge is created, shared and used in organizations (Servin & De Brun 2005).

If we summarize the current need, it can be easily identified that there is a need to have a learner-centric environment in which the learner is not just a passive recipient of information but an active participant in knowledge acquisition. The major concern that remains in an e-Learning environment is how to improve the process of knowledge acquisition. The role of an instructor or teacher needs to be modified such that knowledge together with domain information can be delivered to Learners.

Currently the science of learning is not only focusing on applications which transfers repeatable content, but applications which deliver the content in a new context and LMS in the future would have the ability to offer a richer content and a new learning experience for the user. This may help with retention of information and application of knowledge into work, leading to the development of new skills and deeper approach towards learning. Further, it increases the focus on understanding the content delivered rather than simply relying on memorization of the course material.

One way to generate knowledge is to design Knowledge Management System (KMS). Through these systems, small and relevant information about any domain is created. They are referred as knowledge nuggets in this paper. However, these knowledge nuggets are usually unstructured and hence cannot be a part of LMS directly. We need to convert these knowledge nuggets to structured objects called Knowledge Objects (KO) using an expert system. These KOs can also be used in a learning environment.

A classification technique, is adopted in this paper, which allows KOs to get associated with LOs. Thus, KOs are classified with different LOs and the resultant LOs can be considered as Knowledge Driven Learning Objects Through these KDLOs, the learners receive requisite Knowledge We had used decision tree algorithm for classifying the KOs with respect to LO. The basic idea of this research is to deliver a more valuable learning asset to the student and offer a right learning experience to each student in an e-Learning environment.

2. Background

2.1 Learning objects

The Learning Objects (LO) are now considered as a fundamental element of a new conceptual model for content creation and distribution. They can be defined as a reusable chunk of data that can be used as a modular building block for e-Learning content. The various structures of LOs were discussed and proposed (Wagner 2002; Wiley 2002; SCORM 2005; Heins & Himes 2006; Metros 2003). Reuse and repurpose of the LOs enables an LO to be used in different ways and in different programmes (Watson 2010; Collis & Strijker 2004; Gunn et al 2005; Polsani 2006). These objects stored in the Learning Object Repository (LOR) are fetched using metadata. There are many widely available metadata standards. (IMS 2006; Dublin core 2012; IEEE LTSC 2002; SCORM 2005) Among these Instructional Management System (IMS) and Sharable Courseware Object Reference Model (SCORM) handles both metadata specification and content structure modelling.

2.2 Learning management systems

LMS has been widely used in higher learning institutions as a mechanism to aid teaching and learning process. LMS provides an infrastructure and a platform through which learning content is delivered and managed (Balki 2010). The software tools of LMS have a variety of functions related to online and offline training, administration and performance management. It provides interaction between learner, instructors and content. The core modules of any LMS are student registration, course enrolment, course delivery, student performance tracking and student assessment. The LMS uses standardization in its construction and many organizations had developed regulations or recommendations about it.

2.3 Knowledge object

To extract knowledge in any organization tools and techniques of KMS is used. Knowledge Management (KM) is facilitating the processes by which knowledge is created (Tacit knowledge), shared and reused in organizations, so that an organization can obtain the greatest value from the knowledge available to it. The
Tacit Knowledge in a Knowledge Conversion Process can be considered as the content for Knowledge Object. Merrill (1999;2000) defines a Knowledge Object as:-

“\textit{A record of information that serves as a building block for a Knowledge Management System. It has a content, method of organizing a knowledge base (metadata), rules to identify and categorize Knowledge Components.}"

According to Horton (2001):

“\textit{A Knowledge Object is a chunk of electronic content that can be accessed individually and that completely accomplishes a single goal.}"

Knowledge Object contains elements, like goal, content and support metadata (summary, introduction, keywords, related knowledge object, security information). A KO also represents information that has been semantically conceptualised (Ruffner & Deibler 2008). Finding ability and reusability are two important features to be taken into consideration while creating a Knowledge Object. This finding ability can be achieved by a metadata and reusability by using a Knowledge Object in various learning contexts and with the advancement of IT technologies, it is possible to dynamically create and distribute the knowledge and make it as a part of the learning mechanism. The various techniques used in extraction of knowledge in an organization are Communities of Practice, Sharing Best Practices, Knowledge harvesting, Peer assists, Social network analysis, After Action Reviews (AAR), Storytelling (Servin & De Brun 2005).

An educational organization involves various learning processes and this information can be collected from course plan, lesson plan, assignments, quizzes, tutorials, seminar etc. This data is usually uploaded on the portal of the college or organization. Some explicit knowledge can be generated through the quantitative feedback from students/learner through feedback management system and result analysis. Some of the tacit knowledge extracted within an educational organisation is achieved through the collection and storage of research projects in project management system and the creation of new knowledge and extraction through innovation management system. These are various forms of knowledge nuggets within the organisation.

Today’s e-Learning environment consists of several components of web 2.0 applications such as wiki, web logs, social book and Really Simple Syndication (RSS) feeds. The aim of the wiki was to develop an easy to use KMS enabling effective and efficient online collaboration. They are also apt for preserving and organising knowledge. Web logs contain rather simple units of information, permitting a more agile management of information. Bookmarks relating to any kind of web resource are stored in databases and social book marking generates a comprehensive and thoroughly indexed collection of scholarly resources. (Blees & Rittberger 2009). These also can be chosen as sources of knowledge nuggets after evaluation from an expert panel.

3. Proposed problem

3.1 Conversion of knowledge nuggets to knowledge object

The Knowledge Nuggets which are extracted from various systems need to be evaluated by an expert panel and get converted from an unstructured entity to a structured entity. This can be achieved by encoding it with a semantic relevant description of a particular object. Thus, adding a learning objective and requisite metadata these knowledge nuggets are converted to a KO which forms the building blocks of knowledge base, an integral part of the KMS. These conversions can be done through an expert system of KMS or by Ontology and are shown in Figure 1.

![Conversion of knowledge nuggets to knowledge object](image)

Figure 1 Conversion of knowledge nuggets to knowledge object.
3.2 Proposed Knowledge Driven LMS
An LMS is a static system with defined tools for all learners. They deliver the content framed by a teacher or contributor. Today a more responsive and personalized experience of learning is needed by the user. So ideally the material that the learner receives must be blended with core knowledge of that subject saved as a knowledge object in the knowledge base of KMS, permutation of content objects which are stored as LOs in LMS. The idea proposed here is to develop an enhanced LMS, which has LOs and can be combined with extracted KOs from KMS to form as KDLO (Knowledge Driven Learning Object which can be delivered to the learners. These learning contents, make an effective use of various distributed knowledge, which enriches learning experiences of the learner or we can say a Knowledge-pull occurs in a knowledge driven LMS, where, along with the learning content, the knowledge is pulled and the need of a particular learner can be fulfilled to a great extent. Formation of a KDLO can be achieved by natural language processing, artificial intelligence, ontology and data mining. Classification, a data mining technique is used for the formation of KDLO.

3.3 Granularity
Granularity defined by IMS is, ‘the relative size of the resource’. According to IEEE, ‘It is an aggregate level or the functional size of the resource’. Granularity in the context of the LOs is often used to refer to the size of an object. Different scholars had discussed theoretical account of the aggregation level of a LO (Thompson & Yonekura 2005; Balatsoukas et al 2008; Wiley, Gibbons & Recker 2000). The term granularity refers to an object with the smallest level being a picture or a text and the largest being a set of courses. In a static e-Learning environment, a full course would be considered as grain size. However, in a dynamic LMS environment, we need a variety of objects so that more options can be delivered to the learner, and a semantic and cognitive approach can be used for identifying the most relevant object for the user. According to Hodgins (2002), a relevant object is one of the key strategies that determines how successful a LO is. A finer level of granularity ensures a greater potential to reuse of objects. Porter 2001, describes the notion of modules or modularity as “a key to provide flexibility for learners to use objects”. Designing learning as a modular concept in contrast to a course concept allows us to move from the ‘traditional course-building approach’ to that of ‘building-block concept’. In this paper, we had considered an environment where learners have a wider choice to select a LO for a particular subject and also there are a number of small KOs which can be attached to LO. The resultant KDLO also enhances the knowledge delivered with LO. However, for the sake of simplicity, relative size of a KDLO can be considered as one or two.

3.4 Proposed Model

![Figure 2: Formation of KDLO](image)

3.4.1 Model Description

The proposed model of KDLO is given in “Figure 2”. The model can be explained in the following steps.
1. Generation of LO and Metadata in LMS.
2. Extraction of Knowledge nuggets from the user through KMS and the conversion of nuggets into KO by adding a goal or an objective and Meta Data.
3. Convergence of LO and KO is done through Classification algorithm of data mining.
4. The decision tree classification technique is used for getting the KDLO as shown in Figure 2. Here, the Metadata of both LO and KO are considered for the classification algorithm.
5. For each LO we may have one or more associated KO which can be further considered as a part of Instructional unit.
6. Based on the user need the relevant KDLO can be delivered.

3.5 Data Mining Technique::Classification

The aim of data mining process is to extract implicit knowledge from large volumes of data sets and transform it into an understandable structure for further use. These techniques are being used in various domains including educational domain. Data mining contains several algorithms and techniques for finding interesting patterns from large data sets. These are classified into two categories, namely, supervised learning (classification) and unsupervised learning (clustering) (Tan et al 2006). The classification algorithms of data mining are decision tree, rule based classifier, naïve Bayes classifier and K-Nearest Neighbour.

Classification is the task of learning a target function that maps each attribute set ‘x’ to one of the predefined class labels ‘y’. A Classification Model is useful for both descriptive and predictive modelling. A descriptive modelling can serve as an explanatory tool to distinguish between objects of different classes. In this approach, the metadata of the LMS has more attributes than that of KMS, thus the classification model can suitably be used to predict the class label of unknown records. Classification techniques are also most suitable for predicting or describing data with binary or nominal categories.

3.5.1 Need of Classification Technique –Decision Tree

We chose a Decision tree (Wu et al 2008) structure, which is self-explanatory as it can handle high dimensional data set (There are 63 attributes, which were identified by IEEE in the metadata standard of LMS). They are computationally inexpensive, and we can construct models quickly, even for a large data set (LMS and KMS are definitely a huge data set where the new LO and KO can be added as and when created or needed). As LMS and KMS may have redundant attributes, choice of decision trees is further justified as the presence of redundant attributes does not affect the accuracy of a tree. If an attribute is redundant with other, then one of the two attributes will not be used for splitting once the other attribute is chosen. Some other characteristics (Tan et al., 2006) which support our choice to select Decision Tree are:

- Decision tree induction is a non –parametric approach for building model. It does not require any prior assumptions regarding the type of probability distribution satisfied by the class attribute or other attributes.
- Decision tree uses a heuristic based approach to guide their search in hypothesis space.
- Classifying a test record is fast with a worst-case complexity O (w) where w is the maximum depth of the tree.
- The decision tree is quite robust to noise when methods of over fitting are employed.
- As a result of classification, one or two KO can be classified to LO. It is represented as Knowledge Driven Learning Object. A delivery engine will deliver the appropriate KDLO to the user based on his or her requirements.

3.5.2 Algorithmic approach of Decision Tree (Han et al 2006)

Input: The training samples D, samples, represented by discrete-valued attributes; the set of candidate attributes, attribute-list.

Output: A decision tree.

1) Create a Node N

2) If <Tuples in data set D belongs to the same class>
   then label the node with class C and return N as the leaf Node.
3) If <attribute list is empty >
   then label the node with majority of class C and return N as the leaf Node

4) Apply Attribute selection Method (d, attribute) to find the best splitting criteria.

5) Label node N with splitting attribute and branches for the outcomes as ‘J’
   (If Splitting criteria are discrete multi way split)

6) New attribute list = attribute list –splitting criteria

7) For Each outcome j of the splitting attribute, Let D_j Be the set of tuples satisfying outcome J.
   If D_j is empty
   { then attach a leaf node with majority class in D to Node N}
   else if D_j be is not empty
   {then generate decision tree (D_j new attribute list)
    attach a node return by generate decision tree to N}
   end for.

Attribute selection Method (d, attribute ‘A’)
- An attribute selection measure like info gain or Gini index is applied to the attribute.
- If ‘A’ is a discrete value ( the outcome of the attribute A) for test node N then for having each
  known value of ‘A’ a branch is created.
- If ‘A’ is a continuous value (the outcome of the attribute ‘A’ has two possible values) for test
  node N Then the value of ‘A’ has a split point and two outcomes (A<=splitpoint) and (A>=
  spiltpont).
- If ‘A’ is a discrete value and a binary tree to be produced, then returns a splitting subset of ‘A’
  which has two outcomes
- Return Splitting Criteria

4. Experimental Setup

Dublin Core metadata contains 15 metadata attributes and IEEE Metadata standard has more than sixty
attributes.
- Dublin Core uses metadata like title, subject, contributor, date created, type. e.t.c and these attributes are
  considered for LOs.
- KO can have metadata like title, author, date created, time, knowledge source, patent, knowledge type,
  knowledge objective.
- In the data cleaning step, set of five common attributes has been identified based on entropy measure
  and are considered for both KO and LO.
- They are an object id, title, author name, topic and sub topic.
- A data set of the 100 Learning Object Metadata is considered during the training phase and a set of 15 of
  KOs are considered for the test phase.
- Rapid Miner (RM) Tool is used for classification using decision tree.

Following steps were performed:-
Step 1: LOs and KOs metadata are loaded into rapid miner as shown in Figure 3.
Step 2: A Simple Validation tool as shown in Figure 4 randomly splits up the example set into two parts, i.e., training set and a testing set. The purpose of the training set is to create models, whereas the testing set is used to estimate the accuracy of the created model. Here, cross-validation operator of RM is used. Cross-validation is a standard statistical method to estimate the generalization error of a predictive model. In the training phase, the cross-validation is built on the current training set.

Step 3: A Decision tree operator of RapidMiner is used to classify nominal data on the training part as shown in Figure 5.

Step 4: Apply Model operator is used in the testing part. Models obtained after the training part usually contain information about the data on which they had been trained on. This information can be used for predicting the value of a possibly unknown label (Refer Figure 5).

Step 5: Validation allows us to estimate the accuracy of our model and Rapid Miner provides a tool, Performance Operator. (Refer Figure 5)
5. Result & Analysis
As there are more than two categories for the attribute used as the class label, C4.5 algorithm is used for the classification. A gain ratio is evaluated to decide the splitting criteria of the variable. Here in the experiment the class label taken is ‘object id’, which has a number of categories. The formation of KDLO proposed in Figure 2 is achieved using the data set and the output is shown in Figure 6. The KO1 and KO3 are classified together with LO9 for the data as follows:-
- Topic: Data Mining Theory.
- Sub Topic: Association.

5.1 Text View of DT
According to the “Text view” of Decision Tree shown in Figure 6, the KO1 & KO3 has been classified with LO9 based on Metadata attributes “topic” and “subtopic”.
For the given attributes, topic “dm theory” and subtopic “association” classifies a Learning Object (LO9) with KO1 and KO3. The output of KDLOs is further explained in “Figure 6a”.

![Figure 5 Decision tree tool in Rapid miner](image)

![Figure 6 Decision Tree in text view](image)
5.2 Graphical View of DT
Figure 7 shows the decision tree in a graphical form. The graph shows the attributes like title, topic, sub topic and author name form the nodes. The attribute “topic” has the highest entropy value and it is the root node. The object_id was chosen as the label, they are the leaf nodes.

Figure 7 Graphical view of Decision tree

5.3 Results of Performance Vector
In the testing phase, the accuracy of the decision tree is computed on the test data set as shown in Figure 8. The accuracy of a performance vector is 55%. (The arithmetic mean is ‘54.74%’ and ‘8.48%, is standard deviation).
6. Conclusion and Future Scope

By converging KO with LO, during the routine learning a learner gets a bigger picture of the topic to learn. It is one way to reinforce the value in learning, which can build knowledge elements into training programmes. Here we integrate the static learning resource (LO) and dynamic knowledge (KO) during learning, thereby making the learning operations efficient, effective, flexible, high accessible, relevant (Hodgins 2002; Ochoa & Duval 2008) and collaborative. In the above experiment, we have shown one or two KOs classified with a LO. The Knowledge Driven LMS will deliver a LO that can be enriched with the knowledge. According to the experiment, when a user queries for a learning material under course – ‘data mining’, and module-‘dm-theory’, the LO with id- ‘LO9’ is delivered by LMS. Along with it, KO1 and KO3 are also given. Thus, KDLO can be obtained and thereby it can strengthen the contents of objects delivered through the LMS.

We had used decision tree algorithm for classification of LO and KO. The result shows, the KOs getting associated with one of the most relevant LOs. The other classification algorithms like naive Bayes classifiers, k-nearest neighbour and artificial neural network can be used. Other approaches can be done by using clustering and followed by classification. The data mining techniques like clustering algorithms (K-mean, Density Based Scan) can also be used. Text mining techniques which may identify the similarity index between different documents will definitely give a more relevant result. These techniques may further refine the search but at the same time increase the computational cost. However, the need of reusability of KO (Ruffner &Deibler 2008) is very important and can be achieved if we associate the Knowledge Object with more relevant LOs. Relevant and reusable objects can be achieved using Fuzzy Clustering, where an object can belong to more than one cluster. Associating relevance and ranking to the learning objects (Sabitha et al. 2012) can improve the satisfaction level of the end user using the LMS. However the delivery engine can be further modified using the semantic and cognitive approach that justifies the need of the user.

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Wagner, E. (2002). Steps to creating a content strategy for your organization. Best of the, 103.
Differences in Intention to Use Educational RSS Feeds Between Lebanese and British Students: A Multi-Group Analysis Based on the Technology Acceptance Model

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Abstract: Really Simple Syndication (RSS) offers a means for university students to receive timely updates from virtual learning environments. However, despite its utility, only 21% of home students surveyed at a university in Lebanon claim to have ever used the technology. To investigate whether national culture could be an influence on intention to use RSS, the survey was extended to British students in the UK. Using the Technology Adoption Model (TAM) as a research framework, 437 students responded to a questionnaire containing four constructs: behavioural intention to use; attitude towards benefit; perceived usefulness; and perceived ease of use. Principle components analysis and structural equation modelling were used to explore the psychometric qualities and utility of TAM in both contexts. The results show that adoption was significantly higher, but also modest, in the British context at 36%. Configural and metric invariance were fully supported, while scalar and factorial invariance were partially supported. Further analysis shows significant differences between perceived usefulness and perceived ease of use across the two contexts studied. Therefore, it is recommended that faculty demonstrate to students how educational RSS feeds can be used effectively to increase awareness and emphasise usefulness in both contexts.

Keywords: cross-cultural; technology adoption model; developing countries; RSS; virtual learning environments; engagement

1. Introduction

Throughout the last two decades, there has been a profound increase in the use of virtual learning environments, such as Blackboard and Moodle, in higher education institutions to support traditional classroom teaching (Dalal, 2014; Abbasi et al., 2011; Nerantzzi, 2012; Padilla-Meléndez et al., 2013) as well as help students meet their educational goals (Clark and Mayer, 2011; Tshabalala et al, 2014). However, a lack of portability and pervasiveness in such systems can negatively influence peer interaction, resource acquirement, and content delivery (Cold, 2006; Lan and Sie, 2010; Ma, 2012). In response to these weaknesses, these web-based learning systems integrate Really Simple Syndication (RSS) to provides learners with a means to promptly receive updates using any Internet-enabled device (West et al., 2006). RSS is an XML format to syndicate and share content on the Web. It is employed for spreading frequently updated and personalized information among users subscribed to the source of content (Samper et al., 2008; Bouras et al., 2010; De La Torre-DíEz et al., 2013). Consequently, enabling learners to be informed about new educational resources in real time, which might include: new teaching materials; reading lists; topics for discussion; the release of feedback; or any other course-related announcements. This has been shown to enhance communication among peers (D’Souza, 2006) and help individuals track topics of conversation (Richardson, 2005). RSS has also been used to improve student research by providing access to updated compilations of relevant research references (Asmus et al., 2005; Liu, Liao and Pratt, 2009). Thus, RSS feeds present a means to provide portability and ubiquity to virtual learning environments in a way that facilitates the dissemination of new information and consequently has an impact on student collaboration.

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However, while RSS feeds are used successfully in many organizations, the use of RSS in educational contexts can be problematic because of students’ low level of technology adoption (Cold, 2006). Despite its utility and widespread deployment, a Lebanese institution has encountered a high level of resistance to this technology. So, despite having the potential to enhance learning through student interaction, a low level of acceptance has meant its benefits have not been fully realised (Tarhini, Hone and Liu, 2013c; Teo, 2009; Teo and Noyes, 2011; Sharma and Chandel, 2013). Additionally, previous research has shown that RSS-user adoption and acceptance is still below expected with 11% among end users in 2008 and 2% in 2005 (Katz, 2008). It is therefore important for practitioners and policy makers to better understand the acceptance of learning systems in the Lebanese context in order to increase usage, and thereby enhance the learning opportunities available to students in Lebanon. In particular, whether a national influence (culture, socio-economics, etc) influences students’ behavioural intention to use RSS feeds.

Various models and theories have been developed to investigate and understand and predict the acceptance of technology. Examples include: the Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bagozzi and Warshaw, 1989); the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975); Innovation Diffusion Theory (IDT) (Rogers, 1995); the Theory of Planned Behaviour (TPB) (Ajzen, 1991); and the Unified Theory of Acceptance and Use Technology (UTAUT) (Venkatesh et al., 2003). This research employs TAM in order to understand and explain the relationship between individuals’ perceptions and behavioural intentions towards RSS. This is because TAM has: been widely used in similar information systems research (Yousafzai, Foxall and Pallister, 2007); has a parsimonious structure and acceptable explanatory power (Venkatesh and Bala, 2008; Chang, 2010; Tarhini, Hone and Liu, 2013a). Furthermore, the validity and reliability of TAM across a number of different technologies and usage contexts have been examined (Teo and Noyes, 2011; Park, 2009; Venkatesh and Davis, 2000).

A criticism of TAM is that it can be affected by biases in cross-cultural contexts and it may not be sufficient to explain the factors affecting the user adoption of new technology because important factors are likely to vary based on the technology, users and context (Straub, Keil and Brenner, 1997; McCoy, Everard and Jones, 2005; Teo, Luan and Sing, 2008; Tarhini et al., 2015a, b). For example, Straub et al. (1997) tested TAM across three different cultures, finding that TAM produces different explanatory power in behavioural intention between Japan and the United States (i.e only 1%), but similar power between the United States and Switzerland (i.e 10%). However, the argument that TAM doesn’t serve equally across cultures is inconsistent in the prior literature (McCoy et al., 2005; Zakour, 2004; Srite and Karahanna, 2006; Sharma et al., 2014). Of particular concern, in this case, is whether TAM is suitable for use in the Lebanese context and whether it can be used to compare Lebanon to other nations. This is because TAM has not been widely tested in a number of developing countries (Teo et al., 2008). Consequently, there is a gap in the literature, and so it is important to first test the appropriateness of TAM through exploring the psychometric properties of a research instrument to ensure measurement invariance, as well as adequate reliability and validity.

The authors hypothesise that national culture could affect technology adoption in Lebanon. As such, the study described in this article compares a sample of Lebanese students to a sample of students from a different country as a first step to explore potential differences. The United Kingdom was selected as an example of a typical developed country that could be used to conduct such a comparison. This country was chosen because, as shown below in Table 1, the United Kingdom and Lebanon represent nearly reverse positions on all of Hofstede’s (2005) cultural dimensions. In addition, there is a significant contrast in investment in educational technology as financial constraints in Lebanon tend to encourage more traditional styles of pedagogy (Baroud and Abouchedid, 2010).

<table>
<thead>
<tr>
<th>Country</th>
<th>Power Distance</th>
<th>Masculinity</th>
<th>Individualism</th>
<th>Uncertainty Avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lebanon</td>
<td>80</td>
<td>53</td>
<td>38</td>
<td>68</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>35</td>
<td>66</td>
<td>89</td>
<td>35</td>
</tr>
</tbody>
</table>

Consequently, this study extends the literature by applying TAM in the Lebanese context to examine differences that may affect the acceptance and adoption of RSS feeds among British and Lebanese students. The results of this study would be of interest to the research community since it explores the generalizability and validity of TAM in a new national context. Furthermore, it examines potential differences between national contexts that may influence students’ use of RSS feeds. This will help policy makers and practitioners
gain a deeper understanding of students’ acceptance of e-learning technology and consequently lead to enhancements in technology acceptance and learning.

1.1 The Technology Acceptance Model (TAM)

Davis (1989) developed the technology acceptance model (TAM) through the theoretical foundation for the Theory of Reasoned Action (TRA). TRA is a model pertaining to social psychology concerned with the specifics of intended behaviours (Ajzen and Fishbein, 1980). TRA posits that an individual’s behaviour and intent to behave is a function of that individual’s attitude toward the behaviour and their perspectives regarding the behaviour. Behavioural intention also is determined via subjective norms, as behaviour results as a function of all attitudes and beliefs (Masrom, 2007; Tarhini et al., 2014a). According to Davis (1989), the aim of TAM is “to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified” (P.985). According to Venkatesh et al (2003), TAM presumes that behavioural intention (BI) is usually formed as a result of conscious decision making processes. This involves three key variables (see Figure 1): perceived usefulness (PU); perceived ease of use (PEOU); and attitude towards using (ATT) (Davis, 1989; Davis et al., 1989). The TAM postulates that PEOU and PU predict ATT, behavioural intention (BI) is predicted by the user’s attitude (ATT), and the actual use of the system is predicted by BI. Furthermore, the PEOU has a significant influence on PU.

The main foundation of our research is based on TAM and drawing from previous literature that used TAM in an educational context in order to reflect the usage and acceptance of RSS in education. The overall conceptual model is illustrated above in Figure 1 and the sections which follow explain and justify each of the predicted relationships in light of previous findings from the literature.

1.2 Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)

Perceived usefulness (PU) is a predictor that measures individuals’ beliefs regarding whether the use of a particular technology system will improve her or his performance (Davis et al., 1989). Perceived usefulness was used in this study to investigate students’ beliefs about obtaining benefits regarding the use of Blackboard’s system as well as to predict students’ beliefs of using RSS on the Blackboard system. The selection of this factor in the research model was due to the direct and significant influence on user’s attitude to use the technology and also behavioural intention to use the system, which comes from the previous studies (e.g., Teo et al., 2008, Hsu, 2014). Perceived ease of use (PEOU) is a predictor that measures an individual’s beliefs regarding the use of a particular technology system free of effort (Davis, 1989). The PEOU construct was selected in order to investigate students’ attitudes regarding using Blackboard’s system free of effort, as well as to predict students’ intentions of using RSS on the Blackboard system.

TAM posits that PEOU and PU predict the user’s attitude towards the system (ATT). As such, it is expected that users with high level of PU are more likely to have positive attitudes about using the technology. Similarly users with high level of PEOU are also expected to induce positive attitudes. Furthermore, according to Davis (1989), PU was found to mediate the effect of PEOU on attitude. In another words, PEOU indirectly has an impact on attitudes through PU.
1.3 Attitude Toward Using (ATT)

Attitude toward using (ATT) is a predictor that investigates individuals’ beliefs regarding using a particular technology. The casual relationship between PU, PEOU and ATT towards using the technology is supported by a considerable number of studies e.g. (Cheng, Lam and Yeung, 2006; Yu et al., 2005; Tarhini, Hone and Liu, 2013b). Furthermore, Gao (2005) indicated in his study ‘Educational Hypermedia’ that attitude toward using had a direct and significant effect on intention to use. More recently, Teo and Noyes (2014) claimed in their study that attitude toward using had a direct and significant effect on intention to use.

However, attitude toward using has varying degrees of effectiveness based on the field of study, sample, or techniques used for analysis. On the other hand, Masrom (2007), found in her study of ‘learning online’ that attitude toward using did not have a direct and significant effect on intention to use. There are differences in significant and insignificant effects of the intention to use based on the field or sample of the study. This is because the term ‘attitude’ can be interpreted quite broadly and could be directed towards many different facets of using a system, such as ‘attitude towards features’, ‘attitude towards purpose’ or ‘attitude towards benefit’; of which, the latter is the focus in this article.

1.4 Behavioural Intention (BI)

The presence of behavioural intention (BI) in the TAM is one of the major differences with TRA. Behavioural intention is considered to be an immediate antecedent of usage behaviour and gives an indication about an individual's readiness to perform a specific behaviour. In TAM, both PU and PEOU influence an individual’s intention to use the technology, which in turns influence the usage behaviour (Davis, 1989). There is significant support in the literature for the relationship between PU, PEOU and ATT on behavioural intention (Venkatesh and Davis, 2000; Taylor and Todd, 1995b; Davis et al., 1989), particularly in the context of e-learning studies (Zhang, Zhao and Tan, 2008; Yi-Cheng et al., 2007; Park, 2009; Saeed and Abdinnour-Helm, 2008; Liu et al., 2010). It is worth noting, however, that actual usage (AU) of the system was excluded from this study because it was found to be challenging to track individual users based on the available server system logs. This is because RSS feeds are available without requiring a login, to facilitate ease of access. Thus, it was impossible to distinguish individual users, or even distinguish between individual mobile devices, with the data available. Therefore, it was deemed appropriate to only measure behavioural intention.

1.5 Aims of the Study

The overall aim of this study was to explore the appropriateness of applying TAM in the Lebanese context through investigating any potential differences between predictors of behavioural intention technology acceptance between British and Lebanese students. As such, the first five hypotheses are based on the relationships in TAM as shown below in Figure 1:

- **H1**: Students’ perceived ease of using RSS feeds (PEOU) will significantly influence the perceived usefulness of RSS feeds (PU) in both the Lebanese and British contexts, equally.
- **H2a**: Students’ perceived usefulness of RSS feeds (PU) will significantly influence attitude towards the benefits of using RSS (ATT) in both the Lebanese and British contexts, equally.
- **H2b**: Students’ perceived ease of using RSS feeds (PEOU) will significantly influence attitude towards the benefits of using RSS (ATT) in both the Lebanese and British contexts, equally.
- **H3a**: Students’ perceived usefulness of RSS feeds (PU) will significantly influence intention to use RSS feeds available on Blackboard Learn (BI) in both the Lebanese and British contexts, equally.
- **H3b**: Students’ attitude towards the benefits of using RSS (ATT) will significantly influence intention to use RSS feeds available on Blackboard Learn (BI) in both the Lebanese and British contexts, equally.

Further to these hypotheses, it follows that there may be differences between the Lebanese and British students due to external variables that influence PU and PEOU, as shown in Figure 1. Therefore, the following hypotheses are also examined:

- **H4a**: The British students will report a higher perceived usefulness (PU) of RSS feeds, compared to the Lebanese students.
- **H4b**: The British students will report a higher perceived ease of use (PEOU) for RSS feeds, compared to the Lebanese students.
H4c: The British students will report a more positive attitude towards using (ATT) RSS feeds, compared to the Lebanese students.

H4d: The British students will report a higher behavioural intention (BI) to use RSS feeds, compared to the Lebanese students.

H5: There will be a greater proportion of British students using RSS, compared to Lebanese students.

2. Methodology

Consistent with previous empirical research in technology acceptance e.g. (Venkatesh and Bala, 2008; Venkatesh et al., 2003) and similar work within the e-learning context e.g. (Zhang et al., 2008; Liaw, 2008; Cronjé, 2011), a quantitative approach was adopted. A 25-item questionnaire was administered to students at an institution in the United Kingdom and an institution in Lebanon, by a process of convenience sampling. The questionnaire contained at least five items for each of the proposed constructs in the TAM model (PU, PEOU, ATT and BI). These items were adapted for the context of using new RSS feeds that had been introduced within the virtual learning environment, Blackboard Learn. Data collected from this survey were analysed using principle components analysis (PCA) in SPSS 20.0.0 and structural equation modelling (SEM) using AMOS 18.0.1. The PCA technique was applied to cull the larger set of items down to a smaller, more parsimonious scale containing items that were likely to be invariant across the two samples, while also ensuring that the proposed factor structure was appropriate for the items included in the scale. The SEM technique was then applied to ensure that adequate construct validity was present in the data and to verify the level of measurement invariance those items achieved in more detail. As Straub (1997) points out, it is important that any hypothesised latent constructs are measured in an appropriate manner. Researchers must ensure that they are actually measuring what they believe to be measured by ensuring that an appropriate level of construct validity is found. Hair et al (2010) show that if adequate face validity, convergent validity and discriminant validity are found, then together these present sufficient evidence for construct validity. That is, participants understand the meaning of every item in the scale (face validity), a set of items expected to measure a particular latent factor converge on that factor with strong factor loadings (convergent validity), and the extent to which constructs differ by not sharing variance can be established (discriminant validity).

As the two samples are based on two two groups with distinct differences (such as culture), assumptions of measurement invariance need to first be verified. This is because, based on a review of the literature, Vandenbeng and Lance (2000) emphasise that at least some configural, metric, scalar and factorial invariance should be established. Such tests of measurement and structural invariance generally fall into one of five questions about how participants interpret items in an instrument (Byrne, 2006): (1) do the items that comprise an instrument operate in a similar fashion across groups; (2) are the constructs and factor structure equivalent across groups; (3) is the causal structure of the constructs the same across groups; (4) are the means of the factor scores invariant across the two groups; and (5) does the factorial structure of an instrument replicate across different independent samples of the same population? Once such questions have been answered, researchers can have confidence that the meaning of responses to particular items in a scale do not differ significantly across multiple groups and are reliable within-groups. Thus, as recommended by Vandenbeng and Lance (2000), tests were performed to ensure that the configuration of factors were the same across the two cultures (configural invariance), rating scales were interpreted similarly (metric invariance), the quantifiable meanings of the scales meant the same to participants from both cultures (scalar invariance), and factor variances are homogenous indicating the equality of relationships between the latent factors (factorial invariance).

Once invariance has been established in the measurement model, the structural model can be tested to examine the relationships between the constructs. The differences between the model structure in the Lebanese and British samples (H1 to H3) were compared using z-tests on the correlation coefficients between pairs of constructs. Estimated factor scores were then generated using the regression method of data imputation within AMOS. The resulting data from Lebanon and the UK were subsequently compared using independent sample t-tests in SPSS (H4). Additionally, the proportion of students reporting to have previously used RSS to support their studies were compared using a chi-squared difference test (H5).
2.1 Participants and Sampling

The participants in this study comprised of 202 British students attending a university in the United Kingdom and 235 Lebanese students attending a university in Lebanon. All participants were studying in an English-language setting. The institutions were purposively selected based on: offering similar courses, with both institutions predominantly running courses in engineering and technology; similar infrastructure, based on both institutions being founded in the 1900's and having similar levels of infrastructure development; and similar use of web-based learning environments, with both institutions making extensive use of Blackboard Learn and deploying versions of Blackboard that integrate RSS feeds at a similar time.

### Table 2: Demographic Information of Participants

<table>
<thead>
<tr>
<th>Country</th>
<th>Age M (SD)</th>
<th>Gender</th>
<th>Education</th>
<th>Use RSS Feeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male SD</td>
<td>Female</td>
<td>Undergraduate</td>
<td>Graduate</td>
</tr>
<tr>
<td>Lebanon</td>
<td>22.6(4.4)</td>
<td>121(114)</td>
<td>102(133)</td>
<td>51(184)</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>21.8(4.9)</td>
<td>91(111)</td>
<td>101(101)</td>
<td>74(128)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Differences</th>
<th>χ² (df)</th>
<th>χ² (df)</th>
<th>χ² (df)</th>
<th>χ² (df)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t = 1.688</td>
<td>p = .072</td>
<td>p = .179</td>
<td>p = .168</td>
<td>p = .001</td>
</tr>
</tbody>
</table>

Notes: M = mean; SD = standard deviation.

Details of the participants are shown above in Table 2. Due to ethical constraints based on defining a sampling frame based on nationality, the sample was collected using a self-selection method and should therefore be considered a convenience sample. The survey was conducted in-person across a period of 3-weeks by two researchers moving to multiple locations within each institution, namely the libraries, computer suites and study areas. No course credit or other rewards were given to participants in this study. Prior to completing the questionnaire, all participants were briefed on the purpose of the work, and their right to choose not to participate. On average, each participant took no more than 10 minutes to complete the questionnaire.

2.2 Instrument Presentation

The instrument was administered in English to all of the students who volunteered to participate. The questionnaire was first pre-tested for content and face validity in both settings. Apart from providing their demographic information, they responded to 25 items, adapted from the work of Davis (1989) and related works, including: perceived usefulness of the RSS feeds (PU) (5 items); perceived ease of using RSS feeds (PEOU) (6 items); attitude towards the benefits of using RSS (ATT) (8 items); and intention to use particular RSS feeds on Blackboard Learn (BI) (6 items). These items were measured using a 5-point Likert scale ranged from strongly disagree to strongly agree.

### 3. Results

The results initially focus on how the research instrument was refined, based on the results of a principle components analysis and matrix independence tests using Fisher’s method. Following this, the results of a series of measurement invariance tests based on structural equation modelling techniques are shown; determining whether the two samples can be meaningfully compared using the proposed model and associated instrument. Subsequently, a series of t-tests and z-tests test whether the data supports or does not support the hypotheses presented.

3.1 Instrument Development and Refinement

The instrument was refined based on a principle component analysis of the original 25 items included in the survey. Items with low loadings (< .4) on their theorised component, significant cross loadings (> .4 in a different component), and items belonging to undefined components were removed. An analysis using Fisher’s method on these items showed that the two rotated component loading matrices (for Lebanon and the United Kingdom) were significantly different from each other (χ² = 303.79, df = 190, p < .001) and so items with significant z-scores were also removed, maintaining at least three items per factor, until an adequate solution was found (χ² = 105.81, df = 96, p = .231), as shown in Table 3. This refined scale contained 12 of the original 25 items, with a KMO of .763 and a significant Bartlett’s indicating adequate factorability. Both Catell’s scree plot criterion and Kaiser’s eigenvalue criterion indicated the 4 component solution, as hypothesised, were
appropriate. The overall variance explained for the two models were 73% and 71%, for the British and Lebanese samples respectively.

**Table 3: Principle Component Analysis and Fisher’s Test of Independence**

<table>
<thead>
<tr>
<th></th>
<th>British Sample (n = 202)</th>
<th>Lebanese Sample (n = 235)</th>
<th>z-Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BI PEOU PU ATT</td>
<td>BI PEOU PU ATT</td>
<td></td>
</tr>
<tr>
<td>BI1</td>
<td>.892 .151 .064 .171</td>
<td>.844 .070 .044 .178</td>
<td>2.02</td>
</tr>
<tr>
<td>BI2</td>
<td>.900 .059 .145 .210</td>
<td>.862 .000 .133 .103</td>
<td>1.75</td>
</tr>
<tr>
<td>BI3</td>
<td>.898 .057 .116 .113</td>
<td>.758 .004 .126 .238</td>
<td>4.88**</td>
</tr>
<tr>
<td>PEOU1</td>
<td>.101 .797 .181 .183</td>
<td>.162 .811 .025 .033</td>
<td>-0.64</td>
</tr>
<tr>
<td>PEOU2</td>
<td>.074 .888 -.026 .047</td>
<td>.003 .859 .000 .079</td>
<td>0.73</td>
</tr>
<tr>
<td>PEOU4</td>
<td>.067 .783 .214 .004</td>
<td>-.083 .772 .073 .006</td>
<td>1.54</td>
</tr>
<tr>
<td>PU1</td>
<td>.116 .059 .796 .201</td>
<td>.092 .004 .858 .112</td>
<td>0.26</td>
</tr>
<tr>
<td>PU2</td>
<td>.093 .085 .868 .112</td>
<td>.152 -.024 .890 .073</td>
<td>-0.62</td>
</tr>
<tr>
<td>PU3</td>
<td>.086 .206 .708 .113</td>
<td>.047 .112 .689 .128</td>
<td>0.40</td>
</tr>
<tr>
<td>ATT6</td>
<td>.214 -.025 .106 .738</td>
<td>.187 -.001 .184 .798</td>
<td>0.29</td>
</tr>
<tr>
<td>ATT7</td>
<td>.084 .207 .119 .864</td>
<td>.302 .038 .077 .839</td>
<td>-2.35*</td>
</tr>
<tr>
<td>ATT8</td>
<td>.153 .059 .202 .728</td>
<td>.073 .090 .092 .847</td>
<td>0.83</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>4.13 1.85 1.54 1.22</td>
<td>3.63 1.96 1.65 1.29</td>
<td>Fishers $^2$</td>
</tr>
<tr>
<td>% VE</td>
<td>.344 .157 .128 .101</td>
<td>.302 .163 .137 .107</td>
<td>105.81</td>
</tr>
</tbody>
</table>

Notes: Factor loadings have been rotated using a varimax rotation with Kaiser normalization; %VE = percentage of variance extracted. * $p < .05$, ** $p < .01$

Following this stage of item refinement, the following 12 items were included in subsequent analyses, as described below in Table 4.

**Table 4: List of Constructs and Corresponding Items in Final Scale for Further Analysis**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness of RSS Feeds</td>
<td>PU1</td>
<td>I would like to be informed about any activities on Blackboard</td>
</tr>
<tr>
<td>(PU)</td>
<td>PU2</td>
<td>I would like to receive updates on Blackboard as soon as published</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>I would like to receive course information daily</td>
</tr>
<tr>
<td></td>
<td>PEOU1</td>
<td>I find using RSS feeds on Blackboard Learn easy to use</td>
</tr>
<tr>
<td>Perceived Ease of Using RSS Feeds</td>
<td>PEOU2</td>
<td>I find it easy to check for information regarding my courses with RSS</td>
</tr>
<tr>
<td>(PEOU)</td>
<td>PEOU4</td>
<td>I find it easy to look up all recently uploaded materials using RSS</td>
</tr>
<tr>
<td>Attitude Towards Potential Benefit</td>
<td>ATT6</td>
<td>I could improve my learning performance by receiving new information</td>
</tr>
<tr>
<td>(ATT)</td>
<td>ATT7</td>
<td>I could enhance my learning skills</td>
</tr>
<tr>
<td></td>
<td>ATT8</td>
<td>I could increase my interaction with Blackboard</td>
</tr>
<tr>
<td>Behavioural Intention to use RSS</td>
<td>BI1</td>
<td>I intend to receive information through the &quot;course content&quot; feed</td>
</tr>
<tr>
<td>Feeds (BI)</td>
<td>BI2</td>
<td>I intend to receive information through the &quot;announcement&quot; feed</td>
</tr>
<tr>
<td></td>
<td>BI3</td>
<td>I intend to receive information through the &quot;discussion&quot; feed</td>
</tr>
</tbody>
</table>

The descriptive statistics presented below in Table 5 indicate a somewhat positive disposition towards RSS feeds. All means were greater than the midpoint (2.5) for both samples, ranging from 3.51 to 4.09. While the standard deviation (SD) values ranged from .685 to 1.113 for the Lebanese sample, indicating greater variability compared to .836 and .973 in the British sample, these values could still be considered a narrow spread around the mean. However, to ensure adequate multivariate normality in the sample, several cases were removed as outliers based on having a Mahalanobis distance greater than 35 from the centroid.
It is important that the distribution of the data does not significantly depart from a multivariate normal distribution. This can be verified through examination of the univariate distribution index values, with skew indices greater than 3.0 and kurtosis indices greater than 10 indicative of severe non-normality (Kline, 2005). Since the values of the variables for both samples fall well within the guidelines, therefore the data in this study were considered to be normal.

3.2 Examination of Reliability, Convergent Validity and Discriminant Validity

The next step is to assess convergent validity, discriminant validity in addition to reliability in order to evaluate that the psychometric properties of the measurement model are adequate. As advocated by Hair et al. (2010), this can be established in terms of composite reliability (CR), average variance extracted (AVE). The results are shown below in Tables 6a and 6b below.

### Table 6a: Convergent and Discriminant Validities

<table>
<thead>
<tr>
<th></th>
<th>Pooled Sample (n = 437)</th>
<th>British Sample (n = 202)</th>
<th>Lebanese Sample (n = 235)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Sk</td>
</tr>
<tr>
<td>BI1</td>
<td>3.73</td>
<td>.989</td>
<td>-.742</td>
</tr>
<tr>
<td>BI2</td>
<td>3.69</td>
<td>.979</td>
<td>-.652</td>
</tr>
<tr>
<td>BI3</td>
<td>3.46</td>
<td>1.00</td>
<td>-.183</td>
</tr>
<tr>
<td>PEOU1</td>
<td>4.09</td>
<td>.895</td>
<td>-.753</td>
</tr>
<tr>
<td>PEOU2</td>
<td>3.93</td>
<td>.910</td>
<td>-.636</td>
</tr>
<tr>
<td>PEOU4</td>
<td>3.97</td>
<td>.849</td>
<td>-.596</td>
</tr>
<tr>
<td>PU1</td>
<td>3.89</td>
<td>.826</td>
<td>-.361</td>
</tr>
<tr>
<td>PU2</td>
<td>3.76</td>
<td>.805</td>
<td>-.184</td>
</tr>
<tr>
<td>PU3</td>
<td>3.51</td>
<td>.877</td>
<td>-.276</td>
</tr>
<tr>
<td>ATT6</td>
<td>3.66</td>
<td>.977</td>
<td>-.362</td>
</tr>
<tr>
<td>ATT7</td>
<td>3.94</td>
<td>.980</td>
<td>-.673</td>
</tr>
<tr>
<td>ATT8</td>
<td>3.57</td>
<td>1.04</td>
<td>-.219</td>
</tr>
</tbody>
</table>

Notes: M = mean; SD = standard deviation; Sk = skewness; K = kurtosis; n = sample size, after removing outliers and invalid responses. As the maximum-likelihood estimation method was applied during the evaluation of the structural equation model, it is important that the distribution of the data does not significantly depart from a multivariate normal distribution. This can be verified through examination of the univariate distribution index values, with skew indices greater than 3.0 and kurtosis indices greater than 10 indicative of severe non-normality (Kline, 2005). Since the values of the variables for both samples fall well within the guidelines, therefore the data in this study were considered to be normal.
Measurement Invariance

Measurement invariance is established using the approach taken by Teo et al. (2009), which involves producing a configurally invariant model during multi-group analysis in AMOS and incrementally introducing stricter constraints. When good model fit is achieved, despite the increasing number of constraints, the model is deemed to be invariant across the two groups. However, there is not much disciplinary consensus about which values for which fit indices indicate adequate fit. Traditionally, fit would be determined using the minimum fit function $\chi^2$. However, the $\chi^2$ may not be appropriate at large sample sizes because it can be overly sensitive to small differences (Hu and Bentler, 1999). The ratio of the $\chi^2$ static to its degree of freedom ($\chi^2/df$) is often used, where the value should be less than 3 to indicate a good fit of the data (Carmines and McIver, 1981). Many researchers have also suggested other fit indices to indicate acceptable fit (Hair et al., 2010; Anderson and Gerbing, 1988; Steenkamp and Baumgartner, 1998). This study used the Non-Normed Fit Index (NNFI); Root Mean Square Residuals (RMRS); Comparative Fit Index (CFI); and the Root Mean Square Error of Approximation (RMSEA) to evaluate the model fit of the both model. The Akaike Information Criterion (AIC) is also listed to provide readers with a relative indication of comparative model quality. As can be shown blow in Tables 7 and 8, and the following sections, the questionnaire items achieve partial measurement invariance in both the Lebanese and British contexts.

### Table 7: Fit Indices for Invariance Tests

<table>
<thead>
<tr>
<th>Invariance Test</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2 / df$</th>
<th>p</th>
<th>NNFI</th>
<th>CFI</th>
<th>SRMR</th>
<th>RMSEA</th>
<th>AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Sample</td>
<td>99.363</td>
<td>48</td>
<td>2.070</td>
<td>.000</td>
<td>.932</td>
<td>.950</td>
<td>.0550</td>
<td>.073 (.053, .093)</td>
<td>159.363</td>
</tr>
<tr>
<td>Lebanese Sample</td>
<td>58.456</td>
<td>48</td>
<td>1.218</td>
<td>.143</td>
<td>.985</td>
<td>.989</td>
<td>.0453</td>
<td>.031 (.000, .055)</td>
<td>252.243</td>
</tr>
<tr>
<td>Baseline Model (Pooled)</td>
<td>86.133</td>
<td>48</td>
<td>1.794</td>
<td>.001</td>
<td>.973</td>
<td>.981</td>
<td>.0419</td>
<td>.043 (.028, .057)</td>
<td>146.133</td>
</tr>
<tr>
<td>Full Configural Invariance</td>
<td>157.837</td>
<td>96</td>
<td>1.644</td>
<td>.000</td>
<td>.958</td>
<td>.969</td>
<td>.0453</td>
<td>.038 (.027, .049)</td>
<td>277.837</td>
</tr>
<tr>
<td>Full Metric Invariance</td>
<td>167.513</td>
<td>104</td>
<td>1.611</td>
<td>.000</td>
<td>.960</td>
<td>.968</td>
<td>.0448</td>
<td>.037 (.027, .048)</td>
<td>271.513</td>
</tr>
<tr>
<td>Full Scalar Invariance</td>
<td>246.915</td>
<td>112</td>
<td>2.205</td>
<td>.000</td>
<td>.921</td>
<td>.933</td>
<td>.0470</td>
<td>.053 (.044, .062)</td>
<td>382.915</td>
</tr>
<tr>
<td>Partial Scalar Invariance</td>
<td>174.578</td>
<td>108</td>
<td>1.616</td>
<td>.000</td>
<td>.960</td>
<td>.967</td>
<td>.0450</td>
<td>.038 (.027, .048)</td>
<td>318.915</td>
</tr>
<tr>
<td>Full Factorial Invariance</td>
<td>198.394</td>
<td>112</td>
<td>1.771</td>
<td>.000</td>
<td>.949</td>
<td>.957</td>
<td>.0505</td>
<td>.042 (.032, .052)</td>
<td>334.394</td>
</tr>
<tr>
<td>Partial Factorial Invariance</td>
<td>175.932</td>
<td>110</td>
<td>1.599</td>
<td>.000</td>
<td>.961</td>
<td>.967</td>
<td>.0454</td>
<td>.037 (.027, .047)</td>
<td>315.932</td>
</tr>
<tr>
<td>Final Structural Model</td>
<td>176.019</td>
<td>110</td>
<td>1.600</td>
<td>.000</td>
<td>.961</td>
<td>.967</td>
<td>.0451</td>
<td>.037 (.027, .047)</td>
<td>316.019</td>
</tr>
</tbody>
</table>

Notes: df = degrees of freedom; NNFI = non-normed fit index; CFI = comparative fit index; SRMR = standardised root mean square residual; RMSEA = root mean square error of approximation; AIC = akaike information criterion

### Table 8: Results of $\chi^2$ Difference Tests

<table>
<thead>
<tr>
<th>Model Comparison</th>
<th>$\Delta \chi^2$</th>
<th>$\Delta df$</th>
<th>p</th>
<th>$\Delta CFI$</th>
<th>Decision</th>
</tr>
</thead>
</table>

Notes:
3.3.1 Configural Invariance

Configural invariance is satisfied when the basic model structure, such as the relationships between indicators and latent factors, is invariant across the groups. This initial baseline has no between-group invariance constraints, so differences may still exist in factor loadings, intercepts and variances, but it provides a basis for comparison as such constraints are added. It is, however, a critical step because if the data does not support identical patterns of fixed and non-fixed parameters, then the data will not support more restrictive models (Bollen, 1989).

3.3.2 Metric Invariance

Metric invariance supposes that the distance between item-responses (e.g. agree, strongly agree) in a scale represent an equal level of change in latent factor true score across independent samples. To test whether metric invariance is supported by the data, the model in AMOS was constrained, such that the factor loadings (also called the factor loading coefficients) were equal for both groups. Since the constrained model is nested within the model that tested for configural invariance, the results of a $\chi^2$ difference test were examined. A model that achieves metric invariance would have both, good fit to the data in addition to a non-significant difference to the previous model. However, while $\chi^2$ is widely used, researchers suggest that other fit indices, such as CFI, should also be used to evaluate model fit where a difference greater than 0.1 indicates a significant difference (Anderson and Gerbing, 1988; Steenkamp and Baumgartner, 1998; Hair et al., 2010). As can be seen in Table 8 above, the non-significant $\chi^2$ difference ($p = .289$) and CFI difference ($\Delta$CFI = -.010) indicates that full metric invariance has been achieved.

3.3.3 Scalar Invariance

Even though items may be metrically invariant, they may not be scalar invariant. This means that the intercept value (as in regression) may be different across the two groups. Such a result would suggest that a member of one group who responds with ‘agree’ may actually be indicating a different level of agreement compared to a member of another group who also responds with ‘agree’. As can be seen in Table 8 above, the significant $\chi^2$ difference ($p < .001$) and CFI difference ($\Delta$CFI = -.350) indicates that full scalar invariance was not achieved. However, while some items were not invariant, at least one item on each factor was scalar invariant. Testing the model with fewer constraints, therefore, suggests that partial scalar invariance was established ($\chi^2$ (4) = 7.065, $p = .132$, $\Delta$CFI = -.001).

3.3.4 Factorial Invariance

Factorial invariance suggests that the two groups are homogenous in terms of factor structure; therefore, the variance for each factor should be identical across the two groups. As can be seen in the tables 7 and 8, full factorial invariance was not achieved ($\chi^2$ (4) = 23.816, $p = .000$, $\Delta$CFI = .010), but partial invariance was achieved ($\chi^2$ (2) = 1.353, $p = .508$, $\Delta$CFI = .000). This suggests that some factors were invariant across the two samples, suggesting there would be no significant differences, however there were likely to be differences in some of the factors.

3.4 Hypothesis Testing

Several hypotheses were stated in section 1.3, which are addressed here. As stated in the methodology, a series of z-tests were used to examine the causal relationships in the structural model in order to identify statistically significant differences between the British and Lebanese samples, as shown in Table 9.
The results support H2a, H2b, H3a and H3b. All of the expected paths were significant and the results of z-tests comparing the correlation coefficients for differences were non-significant. However, H1 was not supported. The result of the z-test comparing the PU -> PEOU path loading was statistically significant, indicating a difference. Examining the path loadings show the relationship is not significant in the Lebanese sample. This suggests that Lebanese students do not perceive an overlap between usefulness and ease of use in the same way as British students.

Table 10: Mean Differences between British and Lebanese Samples

<table>
<thead>
<tr>
<th>H4a</th>
<th></th>
<th>British Sample</th>
<th></th>
<th>Lebanese Sample</th>
<th>t-Tests</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ATT</td>
<td>3.104</td>
<td>0.539</td>
<td>2.910</td>
<td>0.671</td>
<td>-3.390</td>
<td>-0.311</td>
<td>.001</td>
<td>-0.32</td>
<td>Supported</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PU</td>
<td>3.141</td>
<td>0.590</td>
<td>3.135</td>
<td>0.550</td>
<td>-0.101</td>
<td>-0.010</td>
<td>.920</td>
<td>n.s</td>
<td>Not Supported</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEOU</td>
<td>3.066</td>
<td>0.622</td>
<td>3.410</td>
<td>0.486</td>
<td>6.556</td>
<td>0.608</td>
<td>.000</td>
<td>0.62</td>
<td>Not Supported</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BI</td>
<td>3.512</td>
<td>0.753</td>
<td>3.358</td>
<td>0.728</td>
<td>-2.196</td>
<td>-0.207</td>
<td>.029</td>
<td>-0.21</td>
<td>Supported</td>
<td></td>
</tr>
</tbody>
</table>

Notes: M = mean; SD = standard deviation; z_{std} = standardised (z-)score difference; d = cohen's d statistic

The data support H4a, and H4d. The independent sample t-tests showed that the means for ATT and BI were significantly larger in the British sample. These differences are “small” as described in Cohen’s conventions on effect size (Cohen, 1992). However, H4b was not supported. There was no significant difference between each sample in terms of PU, with both means being larger than 3 indicating agreement. This suggests that the use of educational technology is believed to be useful by Lebanese students, much in the same manner as by British students. Unexpectedly, however, H4c was not supported. A significant different was found, however the Lebanese sample had a much higher mean for PEOU, with "medium" effect. This suggests that Lebanese students believe that they can easily use, or learn to use, RSS feeds more readily than British students.

Note that the descriptive statistics in support of H4 are shown in section 2.1 in Table 2. A Pearson’s chi-squared statistic shows that 36% of students in the British sample had used RSS, as opposed to just 21% in the Lebanese sample ($\chi^2 = 11.859$, df = 1, p = .001). This suggests that British students, however the practical difference is marginal with a difference of 15% which could be explained through differences between the samples.

4. Discussion

The overall aims of this study was to determine the appropriateness of TAM in the Lebanese context and to investigate whether there are differences between British and Lebanese students that influence their intention to use the RSS feeds provided through Blackboard to support their studies. Our result supports the ability of TAM to be a useful theoretical framework for better understanding the student’s behavioural intention to use RSS feeds in education in both Lebanon and the United Kingdom. Overall, the proposed structural model showed a reasonably good fit with the collected data, with the squared multiple correlation indicating that the model explained 39% of the variance in BI for the Lebanese sample and 24% for the British sample. The results showed that all the predictors (PEOU, PU, ATT) were found to be significant determinants of behavioural intentions to use RSS feeds for both samples. However, further exploration indicated that the differences between the Lebanese and British students are greater than the similarities. More specifically, significant differences were detected in the means of ATT, PEOU and BI, whereas no differences were detected in terms of PU. Furthermore, the relationship between PU and PEOU was significantly different between the two samples.
samples. This study further confirms that course materials that use RSS feeds can promote higher user acceptance through stimulating a higher PU.

4.1 Research Implications

Several insightful results could be summarized from our research study, and these are presented below in two categories: contribution to theory and implications for practice.

4.1.1 Contribution to Theory

TAM has been criticized for showing bias in a cross-cultural context e.g. (McCoy et al., 2005; Straub et al., 1997). Furthermore, many TAM studies focus on Western/developed countries, while TAM has not been widely tested within non-western/developing countries (Teo et al., 2008; Fayyomi, Mohammad, and Faris 2013; Tarhini et al., 2014b). Consequently, Teo et al. (2008) and Tarhini et al. (2014c) emphasize the importance of testing TAM in different cultures as it is argued that when Davis developed the TAM (Davis, 1989), he did not take into consideration the un-biased reliability of TAM in cross-cultural settings. That is why Davis (1989) proclaimed that studies examining and enhancing the generalizability and validity of TAM in various technology contexts are demanded. Additionally, the applicability of TAM is limited in the educational settings as much of the research has been carried out in non-educational contexts. Therefore, the first theoretical contribution of this study is to empirically confirm the validity and generalizability of TAM in the context of e-learning adoption in developing countries, exemplified by the Lebanon, and in the developed world exemplified by the UK. As postulated in TAM studies, the belief-attitude-intention stream is still effective in predicting the users’ perception of technology acceptance.

Furthermore, since the findings from technology acceptance models in one country may not be applicable to another country, this study is also beneficial for understanding the importance of cross-cultural studies between the two countries in terms of technology acceptance. Therefore, this study is considered a useful guide for other researchers to understand whether the acceptance of technology is mainly affected by the individuals’ cultural background or whether the acceptance is mainly based on the key determinants of technology itself (behavioural beliefs).

4.1.2 Implication for Practice

In terms of behavioural beliefs (perceived ease of use and perceived usefulness), the results show that perceived usefulness (PU) contributed the most to users’ attitudes towards using the technology compared to the perceived ease of use (PEOU) in the Lebanese and British setting. It is therefore believed that students who find the RSS feeds on e-learning system useful in their learning process and also find the system easy to use are more likely to adopt the system. Therefore, it is suggested that training is not necessary for individuals who have experience in using computers and e-learning; however it is crucial for the other group, since those users will form their perceptions about using the RSS feeds on Blackboard system on the ease of use of the system rather than its usefulness. Thus, by providing training to inexperienced users, those users will be able to learn about the benefits of using the system. This, in turn, will influence their decision to adopt the system. Additionally, instructors should inform the learners about new educational resources such as new teaching materials; reading lists; topics for discussion; or any other course-related announcements in a real time, and they should provide up-to-date content that can fit the students’ needs such as access to updated compilations of relevant research references. This will help educate potential users about the benefits of using RSS on Blackboard since such services are quite new to many users in Lebanon and the UK. In addition, in order to promote the ease of use of e-learning, system developers should provide more user-friendly, simple, and informative interfaces for potential adopters. This will increase the users’ familiarity with the system which in turn upsurge their intention to adopt and accept it.

Despite the above mentioned differences between the two samples, the results indicate that both Lebanese and British students would most likely use RSS feeds in their learning process and considered it a fairly new addition to e-learning, but reports from the data collection suggested many students were not aware of the feature was available in the virtual learning environment until being presented the questionnaire or don’t understand what it is... It might be also that the influence of using RSS feeds on the attitude differs depending upon the user’s current stage of technology adoption. RSS adoption can result in first-mover disadvantage instead of advantage. Under certain conditions, the beneficiary of the new technology adoption is not the first...
adopter, but rather its competitor. Therefore, it is recommend that educators spread awareness of the feature, emphasise the usefulness of the feature and how it can be used to benefit learning in order to encourage intention for use. Adopting suitable information delivery such as RSS technique to support the corresponding learning activities of e-learning systems will help achieve the goal of learning anytime and anywhere. It is also advised that policy makers and instructors should use various message delivery methods (e.g., SMS and Email) to effectively communicates with the students especially when there is a need for immediate information delivery such as notifying or reminding of some time-sensitive matters. More important to acceptance is the proper connecting of the technology (RSS feeds) to the student’s required tasks. Thus learners using different level of communication technique might adopt different acceptance behaviours.

It is also suggested that system developers and designers should provide more personalized summarization system based on a more filtering techniques and algorithms that provide a unique information filtering framework to the target users. The instructors should not only have to locate the new articles and learning materials that the students are interested in reading, but they also have to present information in such a way that the learner will be able to read the most desired and representative parts of it.

The findings of this research also have practical implications to the higher educational institutions and universities in Lebanon and the UK. Although the government of these two countries are investing in technology, it should be noticed that students will not accept and use the technology only because it is useful. Since the students’ perceptions towards using the technology are formed through individual, social and cultural contexts. In this context, all the major and different individual factors should be considered simultaneously; only then a more complete picture of the dynamic nature of individual technology may begin to emerge. In other words, it is futile to facilitate a technology which is implemented in a Western country or for specific group of users and then apply it in non-western countries that have substantial cultural differences without taking into consideration the cultural values. Therefore, policy makers should not consider the strategies related to content, design and structure in one country and simply apply it to another as it will be doomed to fail in other contexts. Additionally, it is recommended that educational authorities should decide on the best approach that fits their students before implementing any new technology.

4.2 Limitations

As with any research, this study has some limitations. Firstly, this study did not integrate cultural variables into TAM and assumed Hofstede’s (2005) findings to be true. As such, it is not appropriate to conclude that the differences found can be attributed to a difference of culture. Further investigation to explore potential moderators is, therefore, appropriate. For example, incorporating a framework to examine cultural differences and other potential influences such as national characteristics and socio-economic status. Secondly, data were collected from students using a convenience sampling technique and thus should not necessarily be considered representative of the population. Therefore, generalization of these findings should be treated with caution. Nevertheless, as a practice, it is acceptable as a first step for further exploration because it is the position of the authors that, from a measurement perspective, a scale found to be variant and have problems using a non-probability sample from a small local sampling frame is unlikely to be invariant using a probability sample in a national sampling frame.

5. Conclusion

In conclusion, the results suggest that models for e-learning adoption should take the nature of the technology into account, as not all perceptions may be salient for all technologies. In other words, It is not clear whether educational technology that has been developed in one location will be perceived in a similar way in a different location. This is due to a range of potential cultural, socio-economic and national differences that may influence behavioural intention to use a technology to support learning. As such, when investigating the adoption of educational technologies in developing nations, it is important to establish the cross-national validity of an evaluative model such as the Technology Acceptance Model (TAM). This research study applied this principle to an investigation of students’ use of Really Simple Syndication (RSS) at a Lebanese higher education institution, making a comparison with British students at an institution in the United Kingdom. Structural equation modelling showed that TAM had a good fit to the data provided by Lebanese students and thereby TAM represent a useful means for understanding technology acceptance in Lebanon. However,
differences were found in terms of perceived ease of use, attitudes towards use, behavioural intention, and reported use, despite no differences in terms of perceived usefulness. Furthermore, the relationship between perceived usefulness and perceived ease of use was also significantly different. As such, future research should examine potential moderators which may influence these variables and their relationships. Additionally, further work to explore the validity of the model in other learning contexts is appropriate.

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Towards the Acceptance of RSS to Support Learning: An empirical study to validate the Technology Acceptance Model in Lebanon

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Abstract: Simpler is better. There are a lot of “needs” in e-Learning, and there’s often a limit to the time, talent, and money that can be thrown at them individually. Contemporary pedagogy in technology and engineering disciplines, within the higher education context, champion instructional designs that emphasize peer instruction and rich formative feedback. However, it can be challenging to maintain student engagement outside the traditional classroom environment and ensure that students receive feedback in time to help them with ongoing assignments. The use of virtual learning platforms, such as Blackboard Learn, and web feed syndication, using technology such as Rich Site Summaries (RSS), can help overcome such challenges. However, during an initial pilot at an institution in Lebanon, only 21% of students reported making use of both these facilities. In this study, the Technology Acceptance Model (TAM) was used to guide the development of a scale to be used to investigate antecedents to the use of web feeds. The proposed scale was reviewed by 4 experts and piloted with 235 students. The collected data were analyzed using structural equation modeling (SEM) technique based on AMOS methods. The results revealed adequate face, content, and construct validity. However, perceived ease of use was not a significant predictor of attitude towards use. Overall, the proposed model achieves acceptable fit and explains for 38% of its variance of which is lower than that of the original TAM. This suggests that aspects of the model may lack criterion validity in the Lebanese context. Consequently, it may be necessary to extend the scale by capturing additional moderators and predictors, such as cultural values and subjective norms. We concluded that the existence of RSS feeds in education improves significantly the content presented by the instructors to the e-learning user decreasing at the same time the size and access cost.

Keywords: really simple syndication, rss feeds, technology acceptance model, technology adoption, e-learning, structural equation modeling, developing countries, Lebanon

1. Introduction

With the rapid development of internet and technology, universities and higher educational institutes around the world, including Lebanon, have begun to focus on the benefits of using e-learning systems as part of improving their teaching and learning activities (Tarhini, Hone and Liu, 2013a; Teo and Noyes, 2011; Ngai, Poon and Chan, 2007). E-learning has many definitions; the definition is usually based on the contexts and environments where it operates (Kanthawongs and Kanthawongs, 2013). In this research, e-learning is defined as learning facilitated and supported through the use of internet technology to deliver information to students with interactions through computer interfaces in order to supplement traditional method of learning (classroom lectures). This way of teaching and learning is also known as ‘blended learning’. One of the major benefits that e-learning systems offer is shifting the focus from instructor-centred to student-centred and the flexibility of time and place in an active manner (Arenas-Gaitán, Ramírez-Correa and Javier Rondán-Cataluña, 2011).

Despite the perceived benefits of using e-learning systems, however, the lack of portability and pervasiveness of these systems can negatively influence peer interaction, resource acquirement, and content delivery (Cold, 2006; Lan and Sie, 2010). In the past, instructors and managements used either Email or SMS as a communication channel to notify the students about the latest learning activities such as new updated material, or new discussion topic (Markett et al., 2006; Liu, Liao and Pratt, 2009; Meurant, 2007). However, these two communication channels have some drawbacks. For example, SMS has content limitations in terms of the maximum allowed characters (Markett et al., 2006), while the content delivered by Email does not...
across different cultural settings, it is important to validate scales in cross-cultural research to ensure biases in cross-cultural contexts e.g. (McCoy, Everard and Jones, 2005; Teo, Luan and Sing, 2008; Rose and Straub, 1998; Straub, Keil and Brenner, 1997). Therefore, since Davis (1989) did not consider potential biases automatically inform the student in a real time to acquire the latest news (Sun and Cheng, 2007). Recently, web-based learning systems have started to integrate Really Simple Syndication (RSS) techniques as a new information delivery mechanism to improve learning performance (Lan and Sie, 2010; Shim and Guo, 2009).

RSS is a lightweight XML application which summarizes website information. RSS feeds allow the users to be notified when the content of certain data on the web has changed, and was made available to the general public in 1999 (Cold, 2006). Thus, RSS provides learners a means to get the latest updates immediately on Internet-enabled devices (West et al., 2006). In other words, RSS provides a one place stop for each module (the syndication) (Hrastinski, 2008). RSS is better because it can be easily used from mobile / web-browser; it is not explicitly a push technology (as browsers pull from server on request) but provides a convenient means to do so (Tarhini et al., 2015a, b). Moreover, RSS formats allow relatively low-bandwidth data gathering. RSS is also important to e-Learning developers because with such technology, it is possible to create and use repositories of learning objects on the public Internet or on a private intranet. Additionally, RSS solves lot of problems that other communication channels (e.g., Email) commonly face, such as spam, increasing traffic and advertising websites (Lan and Sie, 2010). In other words, learners will only receive relevant information and materials related to their learning activities since the instructor can describe and syndicate the content of posted materials (Duffy and Bruns, 2006). Consequently, it serves towards informing learners about the latest learning opportunities in real time, including: new teaching material; course announcements; new reading material; and new topics for discussion. This has been shown to enhance the communication among peers (Prabowo, Thelwall and Alexandrov, 2007; D’Souza, 2006) and help learners track conversation topics (Richardson, 2005). RSS feeds has the potential to be used for public-opinion gathering and can also improve student research by providing access to compilations of in-depth research references with only a few simple clicks and therefore helps the students to remain engaged and ensures the timely delivery of feedback from instructors (Asmus et al., 2005; Fernandez, Simo and Sallan, 2009). RSS can also make part or all content of posted materials available for use by other applications through a feed, which in turn make it available on many different devices, including wireless ones. Thus, RSS provides portability and pervasiveness to virtual learning environments in a way which facilitates collaboration and the dissemination of the latest information, since it glean relevant information related to user’s needs (Cold, 2006).

Although RSS feeds are widely used in many advertising sites and organizations, the use of RSS in education entails the problem of students’ low acceptance and usage (Cold, 2006). As a new technological-pedagogical practice, the technology has the potential to enhance pedagogy when students understand it as another means to improve their education and achieve their learning goals. But, despite the widespread deployment of RSS feeds, there is a high level of resistance to use and accept such technologies due to the asynchronous nature of such interaction; however, it can be challenging to motivate self-regulated learning beyond the traditional classroom environment (Park, 2009). It is essential to consider the students’ acceptance and adoption of technology; otherwise the e-learning system will be underutilized or completely abandoned (Liu et al., 2009; Park, 2009). Therefore, it has become imperative for practitioners and policy makers to better understand the factors that influence the adoption of RSS as a suitable information delivery medium, since it is considered the most major step toward implementing and developing a successful e-learning environment (Teo, 2010a).

Several models and theories have been developed in the past three decades to examine and predict the acceptance levels of specific technologies. Examples include: the Technology Acceptance Model (TAM) (Davis, 1989); the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980); Innovation Diffusion Theory (IDT) (Rogers, 1995); the Theory of Planned Behaviour (TPB) (Ajzen, 1991); and the Unified Theory of Acceptance and Use Technology (UTAUT) (Venkatesh et al., 2003). This study employed TAM in order to understand and explain the relationship between individuals’ perception (such as perceived ease of use, perceived usefulness of the e-learning system) and behavioural intention (see Figure 1). Among other models, TAM is considered the most cited model in the IS research (Yousafzai, Foxall and Pallister, 2007; Bagozzi, 2007) due to its acceptable explanatory power and parsimonious structure (Venkatesh and Bala, 2008).

A number of researchers have examined TAM to explore its validity and reliability across different technologies and usage contexts (Teo and Noyes, 2011; Park, 2009). A criticism, however, is that TAM can be affected by biases in cross-cultural contexts e.g. (McCoy, Everard and Jones, 2005; Teo, Luan and Sing, 2008; Rose and Straub, 1998; Straub, Keil and Brenner, 1997). Therefore, since Davis (1989) did not consider potential biases across different cultural settings, it is important to validate scales in cross-cultural research to ensure
measurement invariance. However, while there are a considerable number of TAM studies that focus on developed countries, TAM has not been widely tested in developing countries (Teo et al., 2008). Consequently, Teo (2010b) emphasizes the importance of testing the TAM in different cultures to ensure adequate reliability and validity. Additionally, the TAM predicts whether users will adopt a general purpose technology, without focusing on a specific topic (Pituch and Lee, 2006). In contrast, this study extends TAM by focusing on specific topics and exploring the behavioral intention to use e-learning technologies, since the applicability of TAM is limited in the educational settings as much of the research has been carried among end-users in the business settings (Kung-Teck, Osman and Rahmat, 2013; Teo et al., 2008).

Furthermore, the argument that TAM model doesn’t serve equally across cultures and the inconsistency in previous studies’ results (Gefen and Straub, 1997; McCoy et al., 2005; Srite and Karahanna, 2006; Straub et al., 1997) highlight the importance of conducting this research in the Lebanese context. Lebanon remains relatively unexplored in terms of technology acceptance and the investment in technology in the educational system is still immature compared to western countries since universities and higher education institutions support traditional styles of pedagogy in education due to the lack of financial resources or trained staff (Baroud and Abouchedid, 2010; Nasser, Khoury and Abouchedid, 2008; Nasser, 2000), which in turn limited the adoptions and acceptance level of technology within such countries.

This research aims to contribute to the stream of literature on e-learning and technology acceptance by applying the TAM to examine the individual students’ perceptions towards the acceptance and adoption of RSS feeds in the Lebanese context. Specifically, this study will examine the relationship between students’ behavioural intention to use RSS feeds in education with selected factors of perceived usefulness, perceived ease of use, and attitude towards usage of the system. This will help the researcher to examine the external validity of western developed theories in non-western countries as well as its robustness and applicability in the context of e-learning. To the best of the author’s knowledge, this research is one of the first studies that empirically and theoretically test the TAM in the context of RSS feeds in Lebanon. Therefore, the present study offers a deeper understanding of the interplay between student characteristics and the usability and interactivity of e-learning environment from a cross-cultural perspective. By establishing a better understanding of the reasons for accepting or rejecting the RSS as a suitable information delivery medium in education by Lebanese students, it is hoped that policy makers can improve the students’ learning experience in using the system that has been developed specifically to respond to current demands of their education (Abbasi et al., 2011).

This paper is structured as follows. In section 2, a summary of literature about the TAM and its development is provided. It is then followed by proposing the research model and describing the research hypotheses in section 3. Section 4 presents the research method that guided the research. Section 5 illustrates the data analysis and results of the measurement and structural model. Finally, section 6 discusses the main findings of the study and concludes the paper with its corresponding implications and limitations.

2. Research Model and Hypotheses

This study employs the TAM for its predictive ability in studies involving students (Teo, 2009b; Kiraz and Ozdemir, 2006). TAM is arguably the most popular model in technology acceptance studies (McCoy, Galletta and King, 2007; Venkatesh and Bala, 2008). Considering the Pros and Cons of the Theory of Reasoned Action (TRA), Davis (1989) proposed a widely accepted theory for representing the technology acceptance behaviour in IT domain. The model was mainly developed to explain computer-usage behaviour and factors associated with acceptance of technology. The TAM states that the success of a system can be determined by user acceptance of the system, measured by three factors: perceived usefulness (PU), perceived ease of use (PEOU), and attitudes towards usage (ATU) of the system (Davis, 1989). Perceived usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her performance" (Davis, 1989). Perceived ease of use (PEOU) refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Perceived usefulness and perceived ease of use can be considered as cognitive factors, whereas Attitude towards usage (ATU) refers to the "the degree to which an individual evaluates and associates the target system with his or her job" (Davis, 1989).

According to Venkatesh et al (2003), TAM presumes that system usage behaviour is predominately explained by BIU that is formed as a result of conscious decision-making processes. The user’s perceptions about the system’s usefulness and ease of use result in a behavioural intention towards using (or not using) a certain
technology (Davis, et al., 1989). In TAM, PU and PEOU tend to have a direct impact on user’s attitude towards the system (ATU), which in turn have a direct impact on BIU (Chang and Tung, 2008; Teo and Lee, 2008). In addition, PEOU has also been shown to significantly influence PU (Rodriguez and Lozano, 2011; Teo, 2009a; Liu et al., 2010).

The BIU is an important factor that will actually utilise the system. By manipulating these factors, users’ beliefs about the system, and subsequently, their behavioural intention and usage of the system will be determined. Figure 1 depicts the causal relationships between PU, PEOU, ATU, and BIU which are specified in the TAM to reflect the students perceptions about using the RSS feeds on Blackboard system to support their education.

Figure 1: Research Model of this study (Davis, 1989)

In accordance with the research objective and consistent with previous research on TAM and related work, this study tested the following hypotheses:

H1: perceived ease of using RSS feeds (PEOU) will have a direct significance positive influence on the perceived usefulness of RSS feeds (PU) in the Lebanese contexts.

H2: perceived usefulness of RSS feeds (PU) will have a have a direct significance positive influence on students’ attitude towards the benefits of using RSS (ATU) in the Lebanese context.

H3: perceived ease of using RSS feeds (PEOU) will have a direct significance positive influence on students’ attitude towards the benefits of using RSS (ATU) in both the Lebanese context.

H4: Students’ perceived usefulness of RSS feeds (PU) will have a direct significance positive influence on intention to use RSS feeds available on Blackboard Learn (BIU) in the Lebanese context.

H5: Students’ attitude towards the benefits of using RSS (ATU) will have a direct significance positive influence on students’ behavioural intention to use the RSS feeds available on Blackboard Learn (BIU) in the Lebanese context.

3. Methodology

1.1 Research Design

This study employs a structural equation modeling (SEM) approach based on AMOS 20.0 to examine the causal relationships and to test the hypotheses between the observed and latent constructs in the proposed research model. SEM has the two main advantages over the use of traditional statistics (e.g., regression). First, SEM has the ability to test the relationships between a serious of independent and dependent constructs simultaneously, and especially where a dependent variable becomes independent (in our case PU and ATT), and second, measurement errors are modelled and computed in SEM to facilitate more precise estimation of item reliability, and thus achieve a good model fit after analysis and modifications (Hair et al., 2010). This study employed two-steps approach during the data analysis process. In the first step, the confirmatory factor analysis (CFA) was employed to assess the constructs’ validity and test the model fit. The next step employed the structural equation modeling (SEM) technique to test the hypothesized relationships among the independent and dependent variables. Using a two-step approach assures that only the constructs retained from the survey that have good measures (validity and reliability) will be used in the structural model (Hair et al., 2010). The sample size of this study was determined based on the rules of thumb for using SEM within
AMOS 20.0 in order to obtain reliable and valid results. Kline (2010) suggested that a sample of 200 or larger is appropriate for a complicated path model. He also advised that in multivariate research (e.g., SEM), the required sample size should exceed by several times (preferably 10 times) the number of variables within the proposed framework or study. Considering the complexity of the model which takes into account the number of constructs and variables within the model, our sample size (235) meets the recommended guidelines.

1.2 Sample and Procedure

A self-report questionnaire was used in this study. Data were collected from 235 students at the end of the academic year (June and July) of 2012 using a convenience sample. Participants were recruited from a range of teaching units at a higher education institution in Lebanon. All participants were studying in an English-language setting and were assumed to be computer-literate. This is because the courses offered by the institution were predominantly technology, engineering and social science based. The virtual learning environment, Blackboard Learn, was also used for most courses, as an institutional policy. All participants were volunteers. No academic credit or financial incentives were provided. As per ethics policies, all potential participants were briefed about the nature of the work and were required to provide explicit consent. On average, each participant took around 11 minutes to complete the questionnaire. Among the 235 returned questionnaires, the average age of the participants was 21.3 years and 48.5% of the participants were female. Approximately, 41% of participants were enrolled on postgraduate modules using RSS feeds, while 59% were on undergraduate modules using RSS feeds. All the participants owned a computer or laptop at home and were mostly found to be experienced in using computers and Internet.

1.3 Measurement scales

Although the questionnaire items were extensively used in previous research related to Technology Acceptance Model, however, there has been some concern over the direct use of the adaptation and application of the Technology Acceptance Model in the context of developing countries such as Lebanon. Therefore, prior to further study, the questionnaire was sent to four experts in technology adoption in order to establish face validity, and then the questionnaire was pilot-tested with 32 students randomly chosen in order to establish content validity and reliability. Some items were reviewed and modified based on the pilot test results.

The final questionnaire consisted of two sections. Section one contained 4 questions to identify demographic characteristics of the respondents such as gender, age, experience and educational level which were measured using a nominal scale. Section 2 contained 15 questions that focused on the scale measuring the constructs in the TAM model (PU, PEOU, ATU and BIU). These questions were adapted from Davis (1989) and related published work (Teo, 2009b; Teo and Noyes, 2011; Tarhini, Hone and Liu, 2013b) where they proved to be reliable and valid. These questions were modified to fit the specific context of the current research. More specifically, PU, PEOU and BIU were measured using 4 items, while ATU towards using RSS was measured using 3 items. A 5-point Likert scales ranging from 1-strongly disagree to 5-strongly agree was used to measure the 15 items of the TAM’s constructs.

4. Results

1.4 Descriptive statistics

All the 15 items were examined for their mean, standard deviations, skewness, and kurtosis. The descriptive statistics presented below in Table 1 indicate a positive disposition towards RSS feeds. The mean values of all items were greater than the midpoint (2.5) and ranged from 3.23 (BIU3) to 4.30 (PEOU1). While the standard deviation (SD) values ranged from 0.66 to 1.10, these values indicate a narrow spread around the mean. However, to ensure adequate multivariate normality in the sample, 5 cases were removed as outliers based on having a Mahalanobis distance greater than 35 from the centroid. In addition, as the maximum-likelihood estimation method was applied during the evaluation of the structural equation model, it is important that the distribution of the data does not significantly depart from a multivariate normal distribution. This can be verified through examination of the univariate distribution index values, with skew indices greater than 3.0 and kurtosis indices greater than 10 indicative of severe non-normality (Kline, 2010). Since the skewness and kurtosis indices ranged from -0.76 to -0.16 and -0.26 to 0.522 respectively, and thus fall well within the guidelines, therefore the data in this study were considered to be normal.
Table 1: Mean, Standard Deviation, Skewness and Kurtosis of Scale Items

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Sk</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIU1</td>
<td>3.75</td>
<td>0.99</td>
<td>-.756</td>
<td>.522</td>
</tr>
<tr>
<td>BIU2</td>
<td>3.64</td>
<td>1.00</td>
<td>-.676</td>
<td>.197</td>
</tr>
<tr>
<td>BIU3</td>
<td>3.23</td>
<td>0.98</td>
<td>-.192</td>
<td>-.114</td>
</tr>
<tr>
<td>BIU4</td>
<td>3.45</td>
<td>1.04</td>
<td>-.372</td>
<td>-.267</td>
</tr>
<tr>
<td>PU1</td>
<td>3.96</td>
<td>0.76</td>
<td>-.349</td>
<td>.089</td>
</tr>
<tr>
<td>PU2</td>
<td>3.78</td>
<td>0.75</td>
<td>-.160</td>
<td>.009</td>
</tr>
<tr>
<td>PU3</td>
<td>3.43</td>
<td>0.88</td>
<td>-.276</td>
<td>.245</td>
</tr>
<tr>
<td>PU4</td>
<td>3.60</td>
<td>0.85</td>
<td>-.572</td>
<td>.422</td>
</tr>
<tr>
<td>ATU1</td>
<td>3.57</td>
<td>1.04</td>
<td>-.372</td>
<td>-.470</td>
</tr>
<tr>
<td>ATU2</td>
<td>3.79</td>
<td>1.04</td>
<td>-.693</td>
<td>-.021</td>
</tr>
<tr>
<td>ATU3</td>
<td>3.45</td>
<td>1.10</td>
<td>-.227</td>
<td>-.694</td>
</tr>
<tr>
<td>PEOU1</td>
<td>4.30</td>
<td>0.66</td>
<td>-.767</td>
<td>-.111</td>
</tr>
<tr>
<td>PEOU2</td>
<td>4.14</td>
<td>0.82</td>
<td>-.643</td>
<td>-.250</td>
</tr>
<tr>
<td>PEOU3</td>
<td>3.69</td>
<td>0.90</td>
<td>-.367</td>
<td>-.227</td>
</tr>
<tr>
<td>PEOU4</td>
<td>4.21</td>
<td>0.70</td>
<td>-.551</td>
<td>-.051</td>
</tr>
</tbody>
</table>

Mardia’s K = 208.7**

Notes: M = mean; SD = standard deviation; Sk = skewness; k = kurtosis; Mardia’s K = Mardia’s Multivariate Kurtosis; n = sample size, † p < .05, ‡ p < .01

1.5 Evaluation of the measurement model

Prior to analyzing the structural model, a confirmatory factor analysis (CFA) based on AMOS 20.0 was conducted to first consider the measurement model fit and then assess the reliability, convergent validity and discriminant validity of the constructs (Arbuckle, 2009). This study adopts the maximum-likelihood estimation (MLE) procedure to estimate the model’s parameters where all analyses were conducted on variance-covariance matrices (Hair et al., 2010; Schumacker and Lomax, 2010).

A variety of fit indices was used in the present study in order to assess the model goodness-of-fit as suggested by Hair et al. (2010) and Kline (2010). These indices represent three different categories of model fit aspects: absolute, parsimonious, and incremental fit indices. These indices were: the minimum fit function $\chi^2$, which is not always the best indication of model fit since it was found to be too sensitive to our sample size (Hu and Bentler, 1999), the ratio of the $\chi^2$ static to its degree of freedom ($\chi^2/df$), with a value of less than 5 and preferably less than 3 indicating acceptable fit (Carmines and McIver, 1981), comparative fit index (CFI), root mean square residuals (RMSR), root mean square error of approximation (RMSEA), normed fit index (NFI), adjusted goodness of fit (AGFI), goodness of fit index (GFI). From previous studies, the values of CFI, GFI and NFI should be equal to or greater than 0.90, and the values of RMSR and RMSEA should be 0.08 or less are indicative of acceptable data fit (MacCallum, Browne and Sugawara, 1996; Hu and Bentler, 1999). Like previous researchers, we made some modifications to fit the entire model to ensure good fit between the model and the data. In this regard, two indicators (PU3, PEOU3) were dropped from the initial measurement model. Table 2 shows the acceptance level fit for the final measurement model. It is clear that all the values were in the recommended range, which suggests that the measurement model has a good fit. Therefore, convergent validity, discriminant validity in addition to reliability can now be assessed in order to evaluate if the psychometric properties of the measurement model are adequate.
Table 2: Goodness-of-fit indices of the measurement and structural model

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Measurement Model</th>
<th>Structural Model</th>
<th>Adequate Fit Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$</td>
<td>74.129</td>
<td>93.897</td>
<td>N/A</td>
</tr>
<tr>
<td>df</td>
<td>59</td>
<td>60</td>
<td>N/A</td>
</tr>
<tr>
<td>$\chi^2$/df</td>
<td>1.256</td>
<td>1.565</td>
<td>&lt; 3.00</td>
</tr>
<tr>
<td>Normed Fit Index (NFI)</td>
<td>.962</td>
<td>.960</td>
<td>&gt; .90</td>
</tr>
<tr>
<td>Comparative Fit Index (CFI)</td>
<td>.971</td>
<td>.969</td>
<td>&gt; .90</td>
</tr>
<tr>
<td>Standardized Root Mean Square Residual (SRMR)</td>
<td>.064</td>
<td>.059</td>
<td>&lt; .08</td>
</tr>
<tr>
<td>Goodness of Fit Index (GFI)</td>
<td>.919</td>
<td>.921</td>
<td>&gt; .90</td>
</tr>
<tr>
<td>Root Mean Square Error of Approximation (RMSEA)</td>
<td>.047</td>
<td>.049</td>
<td>&lt; .08</td>
</tr>
</tbody>
</table>

Notes: df = degrees of freedom

1.5.1 Reliability, Convergent and discriminant validities

Convergent validity refers to the degree to which two measures of constructs that theoretically should be related, are in fact observed to be related to each other (Gefen, Straub and Boudreau, 2000). In other words, it confirms whether each construct can be reflected by its own indicators in order to ensure unidimensionality of the multiple-item factors and to eliminate unreliable indicators (Bollen, 1989). According to Fornell and Larcker (1981), convergent validity of the measurement items can be evaluated using three different measures. These are composite reliability (CR) of each construct, item reliability of each measure, and the average variance extracted (AVE). The item reliability was evaluated by its factor loading onto the original construct. Cronbach’s alpha is used to assess the construct reliability which indicates how rigorous observed variables are measuring the same latent variable. Whereas, average variance extracted, measures the overall amount of variance that is attributed to the construct in relation to the amount of variance attributable to measurement error (Fornell and Larcker, 1981). To establish convergent validity at the item level, the factor loading should be above 0.50. The results in Table 3 shows that the factor loading for all indicators were above the cutoff 0.5, and ranged between 5.9 and 9.9. These results suggest a satisfactory convergent validity at the items level. At the construct level, it is suggested that the AVE should be equal or exceeds 0.5 (50% of the variance of the indicators has to be accounted for by the latent variables) and CR is greater than the AVE (Hair et al., 2010). To establish adequate reliability, Hair et al (2010) suggest that CR should be at least 0.6 and preferably higher than 0.7. As can be shown in table 3, all values of the AVEs for each measure were above 0.5, and ranged between 0.512 and 0.628. In addition, the CR for all constructs was higher than 0.7 and ranged between 0.777 and 0.817, thus demonstrating an adequate reliability and convergent validity at the construct level.

Discriminant validity tests whether concepts or measurements that are supposed to be unrelated are, in fact, observed to not be related to each other (Gefen et al., 2000). According to Fornell, Tellis, and Zinkhan (1982), discriminant validity is considered adequate if the variance shared between a construct and any other construct in the model is less than the variance of the construct shared with its measures. If the square root of the AVE of a construct is greater than the off-diagonal elements in the corresponding rows and columns, this means that the given construct is more strongly correlated with its indicators than with the other constructs in the mode. As can be shown in table 3, the square root of the AVEs in all cases is greater than the off-diagonal elements in their corresponding rows and columns, thus suggesting satisfactory discriminant validity for all constructs.
Table 3: Tests for Construct reliability, convergent validity and discriminant validity

<table>
<thead>
<tr>
<th>Factor Correlations(\alpha)</th>
<th>FL</th>
<th>CR</th>
<th>AVE</th>
<th>BIU</th>
<th>PU</th>
<th>ATU</th>
<th>PEOU</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIU1</td>
<td>.783</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIU2</td>
<td>.829</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIU3</td>
<td>.649</td>
<td>.816</td>
<td>.531</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIU4</td>
<td>.635</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU1</td>
<td>.814</td>
<td></td>
<td>.792</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU2</td>
<td>.865</td>
<td>.777</td>
<td>.550</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU4</td>
<td>.589</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATU1</td>
<td>.748</td>
<td></td>
<td>.841</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATU2</td>
<td>.894</td>
<td>.834</td>
<td>.628</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATU3</td>
<td>.724</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU1</td>
<td>.678</td>
<td></td>
<td>.820</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PEOU2</td>
<td>.807</td>
<td>.812</td>
<td>.512</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU4</td>
<td>.653</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Notes: FL= factor loading; \(\alpha\)= Cronbach alpha; CR = composite reliability \((\sum \lambda^2)/((\sum \lambda^2 + \sum \delta))\); AVE = average variance explained \((\sum \lambda^2)/n\); \(\alpha\) Diagonal in parentheses: square root of average variance extracted from observed variables (items); and off-diagonal: correlations between constructs.

Having achieved satisfactory reliability, convergent validity and discriminant validity at both the item and construct levels, the next step is to test the research model and examine the hypotheses by assessing the structural model.

1.6 Evaluation of the Structural Model and Hypotheses Testing
The same criteria used to measure the goodness-of-fit for the measurement model was also used for the structural model. The results in Table 2 shows acceptable fit between the model and the data \(\chi^2 = 93.897, df = 60, \chi^2/df = 1.565, CFI=.945, GFI=.921, NFI=.941, SRMR=.059, RMSEA=.049\). Therefore, we can proceed to test the hypothesized relationship between the constructs within the proposed research model. These hypotheses were assessed by examining path coefficients and their significance levels.

![Figure 2: Results of the Hypothesized relationships](www.ejel.org)

Figure 2 shows the parameter estimates for the hypothesized research model. 3 out of 5 hypotheses were supported by the data. Specifically, perceived usefulness (\(\alpha=0.251, p<0.01\)) was found to influence computer
attitude, supporting H2. Furthermore, behavioral intention significantly influenced by perceived usefulness ($\alpha=0.212$, $p<0.01$) and computer attitude ($\alpha=0.413$, $p<0.001$), supporting hypotheses H4 and H5. Surprisingly, the results showed that perceived ease of use did not have a significant influence on perceived usefulness ($\alpha=0.071$, n.a) or computer attitude ($\alpha=0.063$, n.a). As a result, this study failed to find support for hypotheses H1 and H3. It should be noted that PEOU, PU and ATU accounted for 38.3% of the variance of BIU, with ATU contributing the most to BIU than the other constructs. It is important to note that our proposed research model explained less variance of BIU compared to the original TAM which means that there are more constructs that should be considered.

5. Discussion

The aim of this study is to understand the factors that affect the adoption of RSS feeds on Blackboard learning environment in Lebanon using TAM. The results of the structural model partially support research hypotheses. In addition and as indicated by the squared multiple correlation of the Behavioural Intention to Use RSS feeds, the overall explanatory power of our proposed model explained 38% of variance which is lower than that of the original TAM and previous studies in technology acceptance. These results yielded insightful practical and theoretical results that could be helpful for university policy makers and also for academics.

Contrary to our expectation and TAM, perceived ease of use was not found to be a significant predictor of perceived usefulness ($\beta = 0.62$, $p=.440$) and attitude ($\beta = 0.215$, $p=.154$). Therefore, H1 and H3 were not supported. Our findings are inconsistent with the results of Tarhini et al. (2014a), which showed ease of use to be a significant determinant of perceived usefulness and attitude toward using web-based learning systems. However, this finding supports the findings of other researchers (Agarwal and Prasad, 1998; Chau and Hu, 2002; Davis, Bagozzi and Warshaw, 1989) who showed that the impact of ease of use on perceived usefulness and attitude will only be critical during the early stage of adoption. This is maybe because the respondents were mostly experienced in using e-learning systems as the use of the system is mandatory, which largely reduces the effect of ease of use. Therefore, it is advised that software developers should develop user-friendly interfaces since they will influence the students’ perceptions to use e-learning services as opined by a recent study conducted by Tarhini et al (2014b) especially during the early stage of adoption.

The results of the coefficient path also showed that perceived usefulness had a direct positive effect on both ATU ($\beta = 0.499$, $p=.002$) and BIU ($\beta = 0.293$, $p=.018$) towards using RSS feeds on Blackboard environment which support hypotheses H2 and H4. Our results are consistent with previous findings of Taylor and Todd (1995) which showed that PU has both behavioural intention towards using technology is directly impacted by perceived usefulness and indirectly via attitude. Our results also support the findings of Davis et al. (1989), Tarhini et al (2013b), which showed that perceived usefulness has a direct significant impact on behavioural intention towards using the technology. Students using the system may benefit from the services and consequently encouraged to use the system. If the students find it useful in their education, in terms of convenient access and prompt services, when compared to the old and traditional means (only face-to-face lectures), then possibly this practice might spread the use of e-learning services throughout the Lebanese society as students will be more willing to use the system. Therefore, it is expected that policy makers should emphasize on the usefulness of the system by improving the quality of their e-learning system rather than ease its ease of use. This will help the students to benefit from the RSS feeds such as the possibility to create and use repositories of learning objects on the public Internet or on a private intranet, live update about learning activities such as new updated material, or new discussion topic.

The results of the structural model also showed that attitude had a direct effect on INT ($\beta = 0.396$, $p=.001$) which indicates that H5 was supported. Compared to other predictors of behavioural intention, attitude was found to be the strongest determinate. This finding is consistent with previous research (Davis et al., 1989; Teo, 2010a). It is therefore advised that policy makers should develop and manage users’ attitude in order to ensure successful implementation of web-based learning services such as RSS feeds.

6. Conclusion, Limitations and Future Research

The main aim of this study was to examine the factors that may affect the acceptance and adoption of RSS feeds on Blackboard system among Lebanese students using TAM. By doing so, we extend the applicability and
generalizability of TAM in a different context. The results of the structural model revealed that PU and ATU to be significant factors in impacting students’ behavioural intention towards using RSS feeds on Blackboard, and accounted for 38% of the variance of behavioural intention which is lower than that of TAM. Unexpectedly, PEOU was not found to be a significant predictor of PU and ATU. Consequently, it may be necessary to extend the scale by capturing additional moderators and predictors, such as cultural values and subjective norms.

As with other cross-sectional studies, it is important to bear in mind some of the weaknesses for the current study before interpreting its findings. First, this research employed a non-random convenience sampling technique. Therefore, the user sample is a major drawback of the current study. Since some might argue that different student groups have different perceptions towards using e-learning systems because of their variant backgrounds. Thus, care should be taken when generalizing the findings of the study. Future research may use random sampling technique which considered a representative of the whole population.

Second, this study studied only one type of user (Lebanese university students) and only one web-based learning system (Blackboard). Future research may include different technologies (e.g. mobile learning), different users (younger age students, disabled students), or different countries especially those with developed countries, such as England or USA in order to extend the applicability of the findings of this study to other contexts. It is easy to argue that a theory applicable to developing countries may not be applicable in developed countries (Teo et al., 2008; Srite and Karahanna, 2006; Venkatesh and Zhang, 2010; Tarhini, Hone and Liu, 2013c; Tarhini, Hone and Liu, 2014c).

Finally, the data for our research model were collected at a single specific time. Since user behaviour is dynamic and constantly changing, we only took a snapshot of this model. Therefore, future research may employ longitudinal study in order to investigate the results at different time periods and also to make comparison. In addition, future research should extend TAM with inclusion of diverse theoretical models and diverse antecedent. This will provide more insight into the phenomenon of adoption and usage of technology.

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Electronic Assessment and Feedback Tool in Supervision of Nursing Students During Clinical Training

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Abstract: The aim of this study was to determine nursing teachers’ and students’ attitudes to and experiences of using an electronic assessment and feedback tool in supervision of clinical training. The tool was called eTaitava, and it was developed in Finland. During the pilot project, the software was used by 12 nursing teachers and 430 nursing students. Nine of the teachers participated in the interviews and survey, and 112 students responded to the survey. The data were mainly analysed with qualitative methods. In the eTaitava web-based user interface, the teacher constructs questions to map the students’ learning process, and sets them to be sent on a daily basis. According to the findings, four-fifths of the students responded to the questions almost daily. They thought the software was easy to use and answering the questions took about 5 minutes a day. Based on the students’ and teachers’ experiences, the use of the electronic assessment and feedback tool supported supervision of clinical training. It supported the students’ target-oriented learning, supervised the students’ daily work, and made it visible for the teachers. Responding to the software questions inspired the students’ cognitive learning, and based on the responses, the teachers noticed which students needed more support and could consequently allocate them more supervision time. Responding also supported the students’ continuous self-evaluation, and considering the responses structured the students’ and teachers’ final assessment discussion. By means of the electronic assessment and feedback tool, it is possible to promote learning during clinical training by challenging students to reflect on their learning experiences. Students’ professional development process can be supported through pedagogically planned conceptual supervision which is integrated into experiential learning during clinical training. The findings of the pilot study were encouraging, indicating that the method is worth further development and potentially useful in supervision in all fields of education.

Keywords: eLearning; mobile application; nursing; clinical training; supervision; reflection

1. Introduction
Information and communications technology creates new possibilities for supervision, but its introduction challenges the teachers’ knowledge, skills, and attitudes as well as the operational culture in education. The fast and continuing development of technology puts pressure on staff competence, budgeting and purchasing of educational institutions, as well as on re-planning the curricula and implementation methods. (Lemke et al. 2009.) Although students and teachers use email every day, educational technology is taken into use surprisingly slowly.

One obstacle to the progression of ICT has been stated to be the autonomy of teachers (Finnish National Board of Education 2011). If the teacher has no interest in starting to use an ICT application in his/her work, educational institutions have hardly ever intervened. Kullaslahti (2011) has studied growth into online teacherhood, and according to her results, teachers’ willingness to introduce educational technology was affected by their prior experiences of using information and communications technology, their views on whether the technology facilitates their work, and if its introduction is related to a development project. Introduction of educational technology requires boldness, courage, and self-confidence to disengage oneself from the old and justify one’s choices. In addition, skills to use diverse communications tools and tolerance of technical uncertainty are needed. (Kullaslahti 2011.) When the use of ICT is increased in education, it is not enough if the teachers become excited; they are often also required to instruct students in using the technology (Tauriainen 2009). In Finland, ICT has been gradually utilised more in education as younger teacher generations have started their work, and nursing education has not been an exception to this. Students’ attitudes towards using ICT in teaching have also become more positive.

ICT tools cannot be simply classified as good or bad; instead, it is essential how people can use them. The surrounding learning environments and pedagogical solutions define their value and significance in supporting learning. (Nurmi & Jaakkola 2008.) Therefore, teachers need to have an innovative approach to experimenting with various technological applications in their own work.

This paper will discuss how an electronic assessment and feedback tool called eTaitava was used as a supervision tool, and the findings of the case study will describe how nursing students and teachers...
experienced it. The ICT-based computer and mobile software could provide teachers with an active supervision method to supervise many students at the same time. By using such a helpful tool, it is possible to be aware of many students’ clinical learning process during the whole training period.

2. Background

Nursing is a practice-oriented discipline. In nursing education, theoretical and clinical studies are linked throughout the education. A third of the studies is implemented as practical training. In Finland, the training periods taking place in institutional and non-institutional health care have been divided into smaller periods of 3-8 weeks. Clinical training is supervised by a teacher and a nurse as the clinical supervisor. Teachers are responsible for providing the students with the theoretical foundation for the clinical training (Tiwari et al. 2005). Earlier, teachers met their students once or twice during a training period, but they do not have sufficient resources to do it anymore, and thus they have to ensure students’ learning by other means (Saarikoski et al. 2009).

The training is evaluated, and the evaluation is based on reaching the objectives set for the training period. At the beginning of clinical training, the students set their own learning objectives, which are based on their learning needs and the learning possibilities offered by the training environment. The objective could be for example to learn how to prepare a sterile operating table, how to insert a cannula into a patient’s arm, how to give home care instructions to a patient, etc. The students discuss their objectives with their clinical supervisor who should support them in reaching their goals. In practical training, the supervisors guide the students and are responsible for them.

Clinical training periods are complex and rapidly changing, and students face challenges in finding their own place in the ward and practice teams (Gidman et al. 2011, Jamshidi 2012). Students have experienced clinical training periods as positive if they have had stimulating and visible supervisors, a permissive atmosphere, and possibilities to reflect (Jonsen et al. 2013). During clinical training, students need support for their clinical skills, clinical training situations (Gidman et al. 2011), critical thinking, and problem solving ability (Jamshidi 2012). The supervision provided by nurses as clinical mentors has often been disturbed by lack of time and the pressure of other tasks (Ball & Pike 2005). If students are not provided with a possibility to participate in the care and learn by doing, their learning outcomes remain poor.

According to the Finnish national training development project, training supervision has to be developed and cost-effective models have to be generated for it. New methods are needed to support students’ learning and professional growth. (Salonen 2007.) The objective is also to support students in learning to learn and self-direction. (Vänskä et al. 2011.)

The theory of constructive learning defines learning as the construction of knowledge. Thus, new knowledge is connected to the existing knowledge. The learner observes, interprets and understands things in relation to his/her own background of knowledge. Understanding is an essential part of learning new skills. When learning takes place in genuine environments, people are easily motivated and learning can be seen in behavioural changes. (Rauste-von Wright 1994.) The challenge of supervision is to encourage the transfer of learnt knowledge into practice. The academic staff and clinical mentors can both play their own role in it. The reflection of authentic situations promotes the students’ competence to think, decide, and act in actual practice. (Mezirow 1990). There is a need to create and adopt continuing assessment methods which would positively influence students’ learning. (Mezirow 1990, Tiwari et al. 2005.)

Feedback is one way to promote students’ professional growth, confidence, motivation, and self-esteem (Begley & White 2003). It is important for students to receive both formal and informal feedback, as well as practical information and advice on how to improve their performance (Clynes & Raftery 2008). On-the-spot comments are typical informal methods of giving feedback and vital elements of the clinical learning experience. Summative formal feedback is given by an appointed supervisor and takes place at the end of the clinical training period. According to studies, students have reported dissatisfaction with the received feedback, possibly due to lack of time or the registered nurses’ inability to give feedback (Clynes & Raftery 2008.)
Clinical supervisors have experienced it difficult to establish an effective relationship with students, provide feedback, and assess students (Moseley & Davies 2007). Student assessment has been experienced difficult, because there are no clear guidelines or assessment criteria (McCarthy & Murphy 2008). Some supervisors avoid giving negative feedback, because they like to maintain a positive relationship with students. Novice supervisors may avoid the feedback meeting with the student for fear of negative comments or over-reaction to criticism. (Clynes 2008.) There is a clear need to instruct the supervisors on how to give feedback (Clynes & Raftery 2008).

New methods are also welcome in student assessment; for example, it would be facilitated by tools, such as simple skills lists, which would give an overall view on the assessed matters (Barnett et al. 2010). According to the study of Kurz et al. (2009), structured graded skills lists used by students as self-evaluation tools improved their learning results. The student’s self-assessment provides valuable insight into the student’s self-evaluated competence and ability to evaluate his or her own performance (Pugh 1992). Self-evaluation, which means the assessment of personal objectives, performance and results, supports the development of reflective thinking, which is important in assessing personal competence in relation to demands set by the working life (Poikela & Poikela 2006).

Students understand their own responsibility in learning and gaining skills (Gidman et al. 2011). Assessment criteria and different tools could help them in self-evaluation process. The use of the electronic assessment and feedback tool described in this study is mainly based on the student’s self-evaluation of skills list statements.

3. Design

3.1 Electronic assessment and feedback tool eTaitava

The electronic assessment and feedback tool, called eTaitava, connects learners, teachers and workplace mentors in on-the-job training environments (eTaitava 2007, Pirttiaho 2007). eTaitava has been used in approximately 30 educational institutions in Finland.

The use of the assessment and feedback tool can be understood as a technology-supported form of on-the-job learning, where learning is seen as holistic information processing and interpretation. In the clinical training place, learning is supported and controlled by technology to achieve the formal learning objectives. (Tauriainen 2009.)

The application can be used to send diverse series of questions to the student and training supervisor to monitor and assess the student’s learning. The teacher constructs the questions through the eTaitava web-based user interface. The questions are saved and set to be sent on certain days. The daily questions can be either open-ended questions or statements such as "I have the basic knowledge of medical diseases" (see figure 1), and the student can answer the questions for example on the scale of 1-5 (fully disagree – fully agree). Another example would be a statement such as "I have practised giving medical injections", which the student would answer using the scale of 1-5 (not at all – very much). (Mettiäinen & Karjalainen 2011.)

The teacher’s challenge is to construct series of questions which guide the student’s learning process in accordance with the objectives and which the student experiences as meaningful. Based on the students’ answers, the teacher has to ensure that the student’s learning progresses during the clinical training period.

Students can answer the questions using either a computer or a smart phone. The answers are saved to the database of the eTaitava software, where the teacher can easily see the individual answers and group-specific summaries presented as graphs (Figure 2). The teacher can follow students’ learning during the clinical training in real time (eTaitava 2007.) Pirttiaho et al. (2007) have described the technical features of the programme in more detail in their paper.
3.2 Construction of question series

In this pilot study, different series of questions were made for each day of the week. In order to facilitate the introduction of the programme in different clinical training periods, such question series were made for Mondays, Wednesdays, and Fridays which were applicable to all clinical training periods. The questions for Tuesdays and Thursdays were made separately for each clinical training period (see Table 1). The same questions were repeated in different weeks in order to be able to follow the progress of learning, which was easy by means of the graphs generated by the programme.
Table 1. Question themes and related examples for different days of the week.

<table>
<thead>
<tr>
<th>Day of the week</th>
<th>Question themes and examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Adaptation to the work community and the student’s activity</td>
</tr>
<tr>
<td></td>
<td><em>In my opinion the work community has a positive attitude to me.</em></td>
</tr>
<tr>
<td></td>
<td><em>I have challenged my supervisor’s habits and practices.</em></td>
</tr>
<tr>
<td>Tuesday</td>
<td>Learning of substance (e.g. anaesthesia nursing)</td>
</tr>
<tr>
<td></td>
<td><em>I have practised entry of patient data into the anaesthesia information system.</em></td>
</tr>
<tr>
<td>Wednesday</td>
<td>Factors affecting the student’s learning</td>
</tr>
<tr>
<td></td>
<td><em>My personal learning objectives guide my learning.</em></td>
</tr>
<tr>
<td></td>
<td><em>The learnt theoretical matters help me in my learning.</em></td>
</tr>
<tr>
<td>Thursday</td>
<td>Learning of substance (e.g. anaesthesia nursing)</td>
</tr>
<tr>
<td></td>
<td><em>I know how to check the ventilator operation.</em></td>
</tr>
<tr>
<td>Friday</td>
<td>Cooperation relationship with the supervisor and assessment of personal learning</td>
</tr>
<tr>
<td></td>
<td><em>I have received feedback on my work from my supervisor.</em></td>
</tr>
<tr>
<td></td>
<td><em>I have searched for further information on clinical training matters at home.</em></td>
</tr>
</tbody>
</table>

Registered nurses’ professional competence requirements have been considered in construction of the questions. In the weekly progressing questions, attention has been paid to the progress of the learning process through motivation and commitment, identification of different matters, and training into mastering the necessary competence and more extensive entities. In all the phases, the questions aim at encouraging students to the continuous assessment of their work.

3.3 Programme introduction
The teachers who participated in making the questions started using the programme with their own students. After the first pilot, the eTaitava software was presented to all nursing teachers (N=70) and all who wanted could start using the software. The teachers received personal guidance in using the programme.

Before a training period, students had an orientation, during which they were told about the objectives and procedures of the clinical training. At the same time, they were taught to use eTaitava. The students were invited to answer the questions sent by eTaitava every day after their shift in the ward.

The supervising teacher presented the idea of the electronic assessment and feedback tool at the clinical training places and taught the supervisors to use eTaitava. Using the programme was voluntary for the supervisors, and they were encouraged to assess the student’s progress once a week by using eTaitava.

According to an earlier study of Mettiäinen and Karjalainen (2011), students (n=112) found it easy to use eTaitava. The questions sent by eTaitava were similar in different weeks and half of the respondents understood that it was a useful way to follow their learning process. Half of the respondents thought the contents of the questions were well designed; the rest of them found them too easy or boring. (Mettiäinen & Karjalainen 2011.) After the first survey, the questions sent by eTaitava have been developed several times.

4. Aims of the study
The purpose of the empirical study was to determine nursing teachers’ and students’ attitudes to and experiences of using the electronic assessment tool in supervision of clinical training.

The studied questions were:
1. What factors contributed to the teachers’ use of the new electronic assessment and feedback tool eTaitava?
2. What was the significance of eTaitava for students’ learning in teachers’ opinion?
3. What was the significance of eTaitava for students’ learning in students’ opinion?

5. Methods
5.1 eTaitava users
The target group was nursing students and teachers in one Finnish University of Applied Sciences. Twelve of seventy (17%) nursing teachers learnt to use the software and used it in their own work with their students.
During the first year, eTaitava was used by all 12 groups, which had 430 students. eTaitava has been in use during 19 clinical training periods, which consist of 3–7 weeks depending on the substance area, i.e. surgical, medical, perioperative, public health nursing, and basic nursing. One student group used it in three training periods, and five groups in two training periods. In addition, supervisors (N=10) from two special fields participated in using eTaitava during the first year (see table 3).

5.2 Data collection and sample
After the first year, nine of the twelve teachers who had used the software were interviewed. The interviews were implemented as group interviews for three persons at the same time. The interviews took about 1.5–2 hours. The interview themes were the teachers’ experiences, and programme benefits and disadvantages. After the second year, all 12 teachers were sent a web-based questionnaire with seven open ended questions. Eight of them answered (see table 2).

After the first year, the survey was sent to 430 students (to all eTaitava users during the first year), and 112 of them answered. In this report, two questions are re-examined. Other findings concerning the students’ experiences were described in the earlier report (Mettiäinen & Karjalainen 2011).

Table 2. Data collection methods and number of participants.

<table>
<thead>
<tr>
<th>Focus group</th>
<th>Method</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers (n=12)</td>
<td>Interview</td>
<td>9</td>
</tr>
<tr>
<td>Teachers (n=12)</td>
<td>Survey with 7 open ended questions</td>
<td>8</td>
</tr>
<tr>
<td>Students (n=430)</td>
<td>Survey (two open ended questions in this report)</td>
<td>112</td>
</tr>
</tbody>
</table>

Table 3. Clinical training periods during which the respondents (students n=112, teachers n=9) used eTaitava in the first year.

<table>
<thead>
<tr>
<th>Clinical training period</th>
<th>Number of groups</th>
<th>Number of students of respondents</th>
<th>Number of teachers</th>
<th>Number of supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basics of Nursing (4 weeks)</td>
<td>3</td>
<td>27</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Medical Nursing (4 weeks)</td>
<td>2</td>
<td>17</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Surgical Nursing (4 weeks)</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Perioperative Nursing (7 weeks)</td>
<td>2</td>
<td>22</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Public Health Nursing (3 weeks)</td>
<td>5</td>
<td>51</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Home Care (3 weeks)</td>
<td>5</td>
<td>53</td>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

5.3 Analysis
During the three group interviews, the researcher wrote down what was stated. The qualitative data from the open ended questions and interviews were analysed by using thematic analysis and categorisation. The data were analysed inductively and deductively through the processes of comparative and content analysis. After the three-step inductive process based on the data (Miles & Huberman 1994), the data were classified into subcategories. After this, the subcategories of student and teacher data were reviewed side by side and the data were re-classified. The categories describing the students’ responses were quantified. Finally, joint top categories were formed to describe the benefits of the programme.

6. Findings

6.1 Information on respondents
83% of the student respondents (n=112) were 20–25 years old and 95% were female. Almost all the students (94%) had a positive attitude towards using information and communication technologies in education. The teachers’ (n=12) age varied from 30 to 56 years and their work experience as teachers from 2 to 27 years. They were all female.

The respondents included both teachers and students who had used eTaitava in several clinical training periods. Most of the students who answered the questionnaire had used eTaitava in the three-week training.
period of public health nursing and/or in clinical training in home care. The teachers had also used the programme most in these periods (see table 3).

79% of the students answered the questions almost every day, 15% 3–4 times a week, and the rest of them once or twice a week. Most of the students did it at home after their shift. Most (68%) of them estimated it took five minutes to answer the questions, and the rest of them reported that it took 10–15 minutes.

6.2 Factors motivating introduction of new technology

In the interviews and questionnaire, the teachers were asked what factors contributed to testing the new electronic tool in supervision of clinical training. The contributing factors can be classified into four categories: 1) general interest in new methods, 2) desire to develop training supervision, 3) need for new supervision methods, and 4) compliance with others’ decision.

Some teachers had a genuine interest in new teaching methods. When eTaitava was presented to them at the health care teachers’ meeting, they experienced it inspiring and interesting. As they were offered the possibility to use the new tool, they started using it out of pure interest or desire to develop their own professional competence.

The teachers also had the desire to develop training supervision, and they considered eTaitava a suitable tool. They wanted better means to support the student’s learning process and self-assessment. They experienced that new structure was needed for training supervision. eTaitava was seen as a tool enabling closer contact with the student. The software also makes it possible to improve the professional and target-oriented interaction between the student, supervising nurse, and supervising teacher, and thus it improves the quality of training supervision and supports its uniformity.

The teachers stated that there is an acute need for new methods. Students complete their clinical training periods around the region and regular visits to the students’ training places are not possible due to lack of time and resources. It is impossible for the teacher to see the students weekly in these cases. During the brief visits, it is not always possible to have enough deep discussions to support the student’s learning, especially if the teacher and student do not know each other in advance.

Some teachers also participated in using the software out of obligation. Other colleagues of the same course had agreed on introducing the software, and hence the rest of the teachers complied with their decision. For some, a contributing factor was that their superior had allocated them resources for learning this new software.

6.3 Teachers’ experiences of the benefit of using the new tool

The teachers were asked how they experienced the benefit of using the eTaitava software in training supervision. The benefits of using the software can be classified into four categories: 1) it made the student’s learning process visible for the teacher, 2) it structured the student’s learning process, 3) it provided the teacher with information about the allocation of supervision resources, and 4) it structured the student’s assessment discussion.

As the students answered the questions sent by eTaitava daily, the teachers experienced that they received almost real-time information on how the students’ clinical training was going, if they had a supervisor in the training place, and if they had been able to participate in work duties. The software offers the possibility to follow the student’s learning and competence development during the training weeks, which provides the teacher with a deeper picture on the student’s learning. The teachers experienced that before the introduction of the eTaitava software, the students were so to say “thrown to the wolves” in the training places.

The teachers found that responding to the questions in the software helps students set better learning objectives for themselves and concentrate on the essential in their learning. Responding forces the students to think about the learnt issues and thus structures their learning.

The software provided the teachers with a tool to consider how often to visit each student, and thus they can allocate more resources to students who need more face-to-face meetings. With the help of the software, the
teachers were informed earlier if the students had difficulties in the training place, and they were able to intervene in the situation in time.

The software reports structured the final assessment, as the teacher now had data on which to base the assessment discussion and assess the achievement of the student’s objectives. In eTaitava, questions can also be made for supervisors to help them in the assessment of the student’s learning. eTaitava has been found to be at its best when the supervisors have also used it. This is a new way for the supervisors to give feedback and assess the student’s competence, which are exactly the areas that have been found difficult in face-to-face contact (Mosely & Davies 2007).

As a whole, the software was experienced very informative. The teachers using the software considered that they could not handle the supervision of several students without eTaitava. It was experienced a necessary tool which they also wanted to use in the future. The software was especially valuable if the students’ training places were far away and the teacher had no possibility to meet them.

The only negative feature from the teachers’ viewpoint was the workload, as it takes a fair share of time to go through the answers. However, along with experience, they learnt to see the reports more effectively and in a selective manner, and thus found the essential information faster.

6.4 Students’ experiences of using the new electronic assessment tool

The students were asked how eTaitava supervised their activities in the ward and what was the significance of eTaitava for their learning process. According to the findings, the significance of the continuous ICT-based supervision tool for learning during clinical training is that it can 1) supervise students to create better learning objectives, 2) supervise students’ daily training activities, 3) inspire students’ cognitive learning process, and 4) help students in self-assessment and reflection.

The students thought eTaitava helped them construct their learning objectives and update them. With the help of the questions sent by the programme, they became more aware of what they should learn.

eTaitava supervised the students’ activities and helped them to pay attention to the asked matters: “It gave my clinical training a buzz, because it brought out the development needs.” Answering the questions reminded them of the objectives of the whole clinical training period: “I maybe did some things more frequently, because eTaitava reminded of them weekly.” eTaitava encouraged students to practise even things that were not in their own objectives: “I noticed that there was something I had not done at all, and I had not even thought that it could be done.”

The questions in eTaitava also helped students become aware of some matters: “I considered the meaning of the work community more.” eTaitava encouraged students to give feedback and find out things from the literature: “‘Have you given feedback to your supervisor’ made me understand that it can also be done.”

Answering eTaitava questions helped students evaluate their learning experiences and the development of their competence. It also showed what the students had to practise more: “It mainly helped to analyse my own learning and clinical training as a whole.”

In addition, answering eTaitava questions helped students think about matters both more independently and with their supervisor: “And answering the questions and giving vent to my feelings probably helped, as I only met the teacher for a couple of times and did not talk about the clinical training matters to others that much.” eTaitava helped students reflect on their learning: “Answering the questions made me think what had happened during the day.”

6.5 Meaning of the electronic assessment and feedback tool for learning and supervision

Based on the students’ and teachers’ experiences, it can be stated that the electronic assessment and feedback tool was useful in the supervision of the students’ clinical training. It supported target-oriented learning, and supervised the students’ daily activities and made them visible for teachers. Answering to the questions in the programme inspired the students’ cognitive learning and, based on the answers, the teachers noticed which students needed more support and could allocate them more supervision time. Answering also
supported the students’ continuous self-assessment, and considering the answers structured the final assessment.

Table 4. Benefits of using the electronic assessment tool as experienced by teachers and students (n means how many students underlined the aspect in question).

<table>
<thead>
<tr>
<th>Students</th>
<th>Teachers</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>How did eTaitava guide your activities in the ward and what was the significance of eTaitava for your learning process?</td>
<td>How did you experience the benefit of using the eTaitava software in training supervision?</td>
<td>Benefits of the electronic assessment and feedback tool:</td>
</tr>
<tr>
<td>It guided me to create better learning objectives (n=27).</td>
<td>It structured the student’s learning process.</td>
<td>It supported the student’s target-oriented learning.</td>
</tr>
<tr>
<td>It guided my daily training activities (n=48).</td>
<td>It made the student’s learning process visible for me.</td>
<td>It supervised the student’s daily activities and made them visible for the teacher.</td>
</tr>
<tr>
<td>It inspired my cognitive learning process (n=19).</td>
<td>It provided information for me on the allocation of supervision resources.</td>
<td>It inspired the student’s cognitive learning and helped the teacher to identify the students in need of more support and supervision.</td>
</tr>
<tr>
<td>It helped me in self-assessment and reflection (n=28).</td>
<td>It structured the student’s assessment discussion.</td>
<td>It helped the student in continuous self-assessment and structured the final assessment discussion.</td>
</tr>
</tbody>
</table>

7. Discussion

7.1 Ethics and reliability

The students and staff were informed about the project when the electronic assessment tool was taken into use. The use of the programme was voluntary but recommended for the students. Using the programme was voluntary for the teachers. The supervisors in clinical training places were informed of the software which the students used, and it was voluntary for them to use it.

The research permit was received from a vice president of the university of applied sciences. Both the teachers and students were told that answering the questionnaires and taking part in the interviews were voluntary. No identifiers were attached to the respondents’ data, and the students’ anonymity was maintained during the whole research process.

Participation in the study did not harm the students or teachers, but possibly helped them consider learning during the clinical training in a deeper manner.

The study has limitations. The target group of the study was 430 students. The loss was 74 %, which weakens the reliability of the results (Munro 1997). The low response rate may have been influenced by the fact that more than six months had gone since some students had used the eTaitava software, and some students had already started their summer holidays. It is also possible that those students who did not actively use eTaitava or did not like it did not respond. Because using the programme was voluntary for the students, some of them did not use it at all, and some tried it only a few times and did not commit to using the programme. The results of the student questionnaire cannot be generalised, but they are encouraging for further research.

75% of the teachers who used the programme participated in the interviews. The interview time did not suit to three teachers. Based on the teacher interviews, it is worth investing in further development.

Some clinical training supervisors participated in using the programme. Two supervisors were interviewed, but the results will not be discussed in this report.
7.2 Introduction of the programme
This paper described the use of a new electronic assessment and feedback tool during nursing students’ clinical training. The study investigated the students’ and teachers’ experiences of the new supervising method and the effects of the technology-supported clinical training on the students’ learning.

The introduction of new educational technology often takes place in projects (Kullaslahti 2011). The participants of this development project were voluntary nursing teachers. They were 12, which is about a fifth of the nursing teachers in the university of applied sciences. The main contributing factors for the teachers starting to use the new tool were a general interest in new methods, a desire to develop training supervision, and a need for new supervision methods. The results confirmed the results of Kullaslahti’s study (2011) on the development into an online teacher stating that personal interest in information and communications technology and motivation to develop the substance were factors which contributed to the introduction of new educational technology among teachers.

With the traditional supervision method, the teachers met the students only a few times during a clinical training period (Saarikoski et al. 2009). In the busy working life, do not have time for face-to-face meetings anymore, and thus new methods are needed (Salonen 2007). Via the ICT-based programme, the teachers are able to supervise many students at the same time and follow their learning process step by step.

The challenge for the teachers is to create right and appropriate questions for different training periods. The teachers experienced the construction of the questions difficult, and the questions were modified and refined several times during the two first years. In addition, Kullaslahti’s study (2011) showed that diverse trials, as well as permitting mistakes and learning from them are typical for online teaching. Approximately half (n=7) of the teachers who used the programme participated in constructing and modifying the questions.

eTaitava cannot be defined as a good or bad tool (Nurmi & Jaakkola 2008) as its value and meaning for learning depend on the use of the software. The software enables an institution-specific way of programming the contents, and in principle every teacher can utilise it as he/she sees best. The introduction of a new method always requires persistence to learn a new way of working; in this case, a new way of supervising students.

7.3 Educational technology can be used to support reflective learning
As the students answered questions sent by the electronic assessment and feedback tool almost daily, they experienced that it guided their daily training activities, helped them in self-assessment, and inspired their cognitive learning process. The students thus had a chance to reflect on their learning experiences during the whole training period.

The findings confirmed the results of earlier studies, pointing out that educational technology can be used to support students’ reflection and assessment of the learning process during training periods, both in nursing education and in other disciplines, too.

In the study of Dearnley et al. (2008), students used electronic portfolios with mobile technology (Pocket PC) to reflect and assess their practice experiences, processes, and outcomes in clinical settings. In addition, according to Biggs (2003), the portfolio made it possible to achieve positive effects by reflecting on the goals of learning, for instance how the student managed to connect theoretical knowledge and patient care in the clinical context. In Lai and Wu’s (2012) study, students did three online activities developing critical thinking using tablets. In these activities, students could reflect their feelings of the daily practice, nursing process, and management of patient problems. Students’ perceptions of the web learning environment were positive and they thought it supported their nursing and reflection skills.

In Mettiäinen and Vähämaa’s (2013) study, nursing students reflected on their learning experiences of clinical training by taking part in a web-based discussion weekly. By sharing their feelings, they noticed the value of peer support. Web-based supervision enhanced professional discussion and helped students connect theoretical knowledge to the practice. It can possibly lead to a deeper understanding and show as better clinical skills. (Mettiäinen & Vähämaa 2013).
Niinimäki (2010) used mobile supervision based on text messages with teacher education students. The students answered the sent questions that assessed the development of their competence. This helped students focus their attention on the key aspects of the teaching practice and provided a basis for the students’ self-assessment. In Tauriainen’s study (2009), vocational upper secondary students used the mobile phone during on-the-job learning periods and wrote an online diary. The students called one another and talked about the events and work. They sent photographs which helped them recall the learnt matters. The use of the mobile phone and web environment became more active during the study; some average users became active users, but the number of passive users remained the same. The use of technology supported information processing and enabled the exchange of thoughts and experiences. According to Tauriainen’s results (2009), professional skills developed further among students who utilised educational technology more.

7.4 Learning becomes visible for teachers through educational technology

The use of the programme made the students’ learning process visible for the teachers, and hence they could better allocate their time to students who needed more supervision and support. Prior studies have also shown that along with online teaching, education has become more student-oriented (Kullaslahti 2011, Valtonen et al. 2007).

In Niinimäki’s study (2010), where teacher education students reflected on their training experiences by using text messages, the teachers commented on them only if necessary – not all messages of all the students. In Lai and Wu’s (2012) study, the web-based reflection environment allowed for the teacher to identify the student’s problems sooner and made it possible to provide more individualised supervision when needed. In Tauriainen’s study (2009), the students wrote what they had done and learnt during the day in an online diary, and thus the teacher became aware of each student’s learning progress. Supervision in the web-based discussion forum offered the teachers the possibility to follow and guide the students’ learning process step by step (Mettiäinen & Vähämaa 2013).

7.5 Challenges of using educational technology

The students experienced the use of the electronic assessment and feedback tool easy. For a majority of young people, learning to use educational technology is not a problem (Tauriainen 2009). The students who answered the questionnaire thought eTaitava was useful for their learning process. However, the questionnaire was only answered by 26% of the student users. The use of the programme was voluntary but recommended for the students. Based on the log data, all students did not use the programme actively.

In his study, Tauriainen (2009) divided students into four user groups based on their technology use activeness. Some students remained passive users of educational technology, but according to Tauriainen, it was more a question of interest in and attitude to studies and educational technology than competence. One reason for the differences between the user groups can be different learning styles. (Tauriainen 2009.)

Students experienced the use of the eTaitava software in a variety of ways. Some students experienced answering the same questions frustrating and others wanted to have more demanding questions. Some students wanted to have questions more seldom, others wanted to have more questions at the same time. Some experienced the programme as a useless extra which was easy to forget. (Mettiäinen & Karjalainen 2011.) Similar results have been received in earlier studies. In the study of Dearnley et al. (2008), there were students who did not see the benefits of using the PocketPC or were afraid of using it.

According to Seppälä (2002), the utilisation of educational technology requires reflection, activeness, and self-direction in the learning process from the student. In addition, technology enthusiasm and willingness to try are needed. Both students and teachers should learn new courses of action and learning strategies (Tauriainen 2009).

The software was introduced on the nursing teachers’ initiative. They had a need to develop training supervision. Only 20% (n=12) of them started using the new tool. The teachers’ autonomy has also earlier been identified as a factor that slows down the introduction of new technology in the school environment in Finland (Finnish National Board of Education 2011). The teachers’ tight schedules may hinder the eagerness with which teachers develop their teaching, as well.
Most teachers who participated in the pilot project experienced the programme easy to use, and they found that the use of the software had pedagogical benefits. It offers the means to make the supervision uniform and to structure the assessment of learning during clinical training.

All teachers did not experience the programme meaningful, and they participated in using the programme because their colleagues wanted to use it. In their opinion, it took too much time to use the programme, and they did not have time to follow the students’ answers in eTaitava.

Along with experience, the teachers learnt to use the programme more effectively. Starting the programme for a student group and setting the timing of the questions kept them busy first, but after a couple of times, active users experienced the mentioned tasks simple and easy. Also Dearneley et al. (2008) note that many educators are at the novice or advanced beginner level regarding the use of electronic tools.

Training is critical for teachers and clinical supervisors, because if the supervising staff is not competent with the used technology, they are not able to encourage students to use it. It is vital that students have an appointed person who can support them in technical questions with ICT devices. (Dearneley et al. 2008.) In addition to pedagogical and substance competence, teachers should have willingness and competence to teach students to use the technology (Tauriainen 2009). This has an important role in encouraging students. The teachers’ attitudes to technology are also reflected in the students’ attitudes.

According to this study, the students used mostly computers at home, but in the future, studying on the move will be probably more and more common. Increase in the use of mobile Internet connections and mobile devices and the availability of better data connections at a lower price have enabled implementing online studies as mobile studies (Tauriainen 2009).

According to prior studies, supervisors have experienced assessment and feedback giving for students difficult. Effective support systems are needed, including preparation and support for both students and mentors (Gidman et al. 2011). Technology gives new possibilities, but at the same time challenges the teachers’ and students’ know-how and attitudes.

The electronic assessment and feedback software described in this study is a good tool for supervising practical training periods in the future as well. Its use should be developed further, and the teachers utilising the programme are the most adept people to develop it. In the future, it could be mandatory for the students to use it, because then every student would be committed to using it. Applying a tool that supports reflection is beneficial for developing one’s competence according to the results of both this and prior studies. The teachers’ commitment to using technology should be initiated based on their own interest and inspiration, since forcing them to use it does not necessarily lead to a meaningful end result.

8. Conclusions
The purpose of this study was not to investigate the features of the eTaitava software but its benefits for learning. The objective was to integrate the use of the electronic tool into learning during clinical training. The objective was achieved for the part of the students and teachers who were committed to using the programme.

The results of this and prior studies confirm the conception that learning can be promoted during clinical training by using educational technology and by challenging students to reflect. It was easier to maintain target-oriented learning during the whole training period by using the electronic assessment and feedback tool. The students’ professional development process can be supported and structured with pedagogically planned conceptual supervision which is integrated with experiential learning during the clinical training.

This pilot study yielded results that were particularly encouraging, indicating that the project is worth further development. However, attention should be paid to the software features, such as user-friendliness, in the introduction of the programme. eTaitava is a good and efficient alternative to supervising training and could be a useful supervision method in all fields of education.
References


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