

# **Promoting Higher Order Thinking Skills via IPTEACES e-Learning Framework in the Learning of Information Systems Units**

**Pedro Isaias**

ADVANCE Research Center - ISEG  
and Universidade Aberta (Portuguese Open University)  
Lisbon, Portugal  
pisaias@uab.pt

**Tomayess Issa**

School of Information Systems  
Curtin University  
Perth, WA, Australia  
Tomayess.Issa@cbs.curtin.edu.au

**Nuno Pena**

ADVANCE Research Center - ISEG  
and UnYLeYa,  
Lisbon, Portugal  
npena@unyleya.com

## **ABSTRACT**

When developing and working with various types of devices from a supercomputer to an iPod Mini, it is essential to consider the issues of Human Computer Interaction (HCI) and Usability. Developers and designers must incorporate HCI, Usability and user satisfaction in their design plans to ensure that systems are easy to learn, effective, efficient, safe, and with fewer errors, while still meeting users' needs and satisfaction. To improve the learning concepts, especially in the assessments regarding HCI and usability, the researchers introduced the IPTEACES e-learning framework in IS6 (Information Systems 6) and WSPD (Website Planning and Development) units in Australia and Portugal higher education respectively. This study elicited experimental evidence based on quantitative and qualitative data from three sources namely: formal and informal student feedback and an online survey to examine students' attitudes to the unit program, assessments, and lecturers' feedback as well the skills they acquired after completing these units. The study outcomes confirmed that students are pleased with the IS6 and WSPD program/unit, assessments, and lecturers' feedback, and believe that they have acquired the necessary knowledge and skills related to HCI and Usability; by completing these units, they have developed various communication skills which will assist them with their university studies and future work in industry.

**Keywords:** Human-computer interaction (HCI), User satisfaction, Experiential learning & education, learning styles, critical thinking, culture

## **1. INTRODUCTION**

To date, many devices have been developed to meet various types of user needs and satisfaction requirements globally and locally. These devices range from the supercomputer to the iPod Mini. To ensure that these devices are efficient, effective and easy to use, designers and developers must consider

Human Computer Interaction (HCI) and Usability factors in the design process. HCI is about designing a computer system or interface which will enable users to carry out their activities effectively and securely. Furthermore, recent studies (Isomursu, Ervasti, Kinnula, & Isomursu, 2011; Maceli & Atwood, 2011; Sigelman & Rider, 2012) indicate that HCI plays a major and important role in developing devices as well

websites to develop interactional techniques and identify the situations where the use of techniques and technologies can be maximized.

Several researchers (Sexton, Miller, & Dietsch, 2011; Te'eni, Carey, & Zhang, 2007; Zheng & Rajapakse, 2007 ) maintain that a good user interface or device enables users to: 1) perform tasks with less need of control and maintenance by other personnel; 2) use the technology with less training time, fewer skills and less support from others; and 3) complete their job if reliability, availability, security and data integrity are available in the interface or device. Moreover, the interface and device must have integration, consistency and portability.

On the other hand, Usability refers to the quality of the interaction between users and interface in terms of performing tasks in less time with fewer errors, performance, functionality, users' satisfaction and retention time (Borges, Morales, & Rodriguez, n.d.; Cowan & Jack, 2011; Davis & Shipman, 2011; Issa and turk 2012; Kanis, 2011).

Therefore, the integration and assimilation of these concepts in the developer's design, in particular of devices, interfaces and websites, will increase sales, reduce costs and boost labor productivity and require less training of personnel. Furthermore, the development, maintenance and support costs will be decreased and users will have a more gratifying experience when working with these devices. By the same token, Flavian, Guinaliu & Gurra (2006, p.2) declared that "Website usability is a very important part of the store's image and ... it can influence shopping behavior in a similar way to those aspects of traditional establishments".

To introduce to students the concepts of HCI and Usability, and other concepts (such as evaluation, task analysis, color, navigation, prototyping etc.) which are related to devices and interface development, the second researcher designed a new unit called IS6 based on her PhD research and results. This unit is a core unit for the Master degree in her School, and the same unit is now offered for the same purpose in Portugal - a unit called WSPD. The researchers used an extensive range of assessments to encourage students to critically examine various aspects of HCI and Usability, and to enhance their communication skills. To enhance students' knowledge of HCI and Usability, the researchers adopted the IPTEACES e-learning framework, comprising seven stages, with each stage focusing on specific tasks to be carried out by students to help them understand the concepts and the aims behind IS6 and WSPD.

This study aims to raise postgraduate students' awareness of HCI, Usability and other concepts, since these are necessary for designers and developers, especially in the 21<sup>st</sup> century. Currently, most devices are developed without designers giving due consideration to these concepts (Issa 2008; Issa and Turk 2012; Lazar, Bessiere, Ceaparu, Robinson, & Shneiderman, 2003; Tuzovic, 2010), and this can lead to user frustration. Therefore, this study is significant as its contribution is both theoretical and practical; it shows the relevance and importance of teaching HCI and Usability in the higher education sector, and identifies the assessments which are required to understand these concepts, by using IPTEACES framework. This study is organized as follow: 1) Introduction; 2) concepts of HCI and Usability; 3) IPTEACES e-learning framework; 4) IS6 and WSPD units, program and

assessments; 5) Participations; 6) Results; 7) Discussion and Theoretical Significance; 8) Lessons Learned; 9) Limitations; 10) Conclusion

## **2. HCI AND USABILITY**

HCI and Usability features are essential in any device, interface or website; if they are integrated in the design process, users will experience more confidence and satisfaction when working with these devices as well as websites. Hence, developers and designers must incorporate HCI and Usability features in their design plans.

Human Computer Interaction is a discipline that is concerned with improving the Usability of a computer system; Usability is achieved when users are able to interact with a computer in an efficient (easy to use), effective, safe, and satisfying manner. High-quality Usability will bring benefits such as increase in trust, satisfaction, loyalty, revenue to the system and greater acceptance of the system.

HCI applies to any type of interaction between humans and computers, from writing a simple email to more complex tasks such as managing a nuclear power plant. The study of HCI is important because of its impact on the way that users interact with computers to achieve their goals through a device, interface and/or website. The communication between users and the device/interface/website provides multi-interaction and communication and provides feedback to make computer- related tasks easier, more efficient, accurate, quick and enjoyable. Several studies (DePaula, 2003; Ficarra, Nichol, Cripolla-Ficarra, & Richardson, 2011; Issa and Turk 2010; Leung & Law, 2012; Shneiderman & Plaisant, 2010; Sørnum, Andersen, & Vatrapu, 2011; Te'eni, Carey and Zhang 2007) indicate that good HCI design promotes reliability, ease of use, communicability, learnability and as a consequence affects the user's productivity and choices.

Issa (2008) defines HCI principles as a means of enabling users (end-users and client-customer users), analysts, and designers (internal and external) to ascertain the practicality of a website design. Many specific design issues need to be taken into consideration when developing website pages; these include text style, fonts, layout, graphics, and color.

Usability is an essential part of the development process of a device, interface and well website. It is the difference between performing a task completely and precisely or not, and user's enjoyment or frustration. Several studies (Fernandez, Insfran, & Abrahão, 2011; Hertzum & Clemmensen, 2012; Issa and Turk 2012; Leung & Law, 2012) indicate that the main purpose of ensuring Usability is to make a device, interface and website easy to learn and easy to use with minimal error impact. The main purposes of a usable device, interface or website are to increase revisit rates and online purchases, reduce users' frustration, increase users' satisfaction, increase the success of the device, interface or website, and most importantly, to increase users' trust especially when dealing with e-commerce.

Lee and Koza (2012) developed ten constructs for usability: consistency (e.g. design, fonts etc.), supportability (e.g. help function), simplicity, learnability, interactivity, telepresence, readability, credibility (security of site), navigability and content relevance. Issa (2013) maintains that

Usability enables users (end-users and client-customer users), analysts, and designers (internal and external) to ascertain that the website design (or interface) is efficient, effective, safe, useful, easy to learn, easy to remember, easy to use and to evaluate, practical and visible, and that it provides job satisfaction. Finally, the integration of HCI and Usability features in the design and development of devices, interfaces and websites, is fundamental to producing outstanding applications that have the potential to enable a massive community of users and businesses to achieve their aims and objectives through technology (Spiekermann & Paraschiv, 2002).

### 3. IPTEACES E-LEARNING FRAMEWORK

IPTEACES is an e-learning framework (Pena & Isaias, 2010a, 2010b; Pena & Isaias, 2012, 2013), primarily inspired by a pedagogical benchmark derived mainly from Gagne, Briggs, and Wager's. (1992) Nine Events of Instruction, Merrill's Principles of Learning (2002, 2007), Keller's ARCS (Attention, Relevance, Confidence, Satisfaction) model (2008), the Ten Steps to Complex m-Learning by van Merriënboer and Kirschners(2007), together with a close observation of award-winning courses such as those recognized by the Brandon Hall Excellence in Learning Awards (BrandonHall Group, 2012), International eLearning Association Awards (The International e-Learning Association, 2012 ) and corporate eLearning best practices (e.g. Bersin & Associates reports (Bersin and Associates, 2012).

IPTEACES (Involvement, Preparation, Transmission, Exemplification, Application, Connection, Evaluation and Simulation), was conceived to facilitate e-learning by streamlining eLearning programmes delivered to non-homogeneous audiences. The Pedagogical Strategies for IPTEACES framework consist of the following phases (Pena & Isaias, 2010a, 2010b):

Simulation), was conceived to facilitate e-learning by streamlining eLearning programmes delivered to non-homogeneous audiences. The Pedagogical Strategies for IPTEACES framework consist of the following phases (Pena & Isaias, 2010a, 2010b):

- **Involvement** - This strategy aims to immerse the student in the context of a real business or corporate scenario, where he is confronted with a problem (Merrill, 2002, 2007). From a pedagogical perspective, it seeks to engage the student (Cf. - Gagné's first event "Gaining Attention"; Keller's (2008) first principle of ARCS - "Motivation to learn is promoted when a learner's curiosity is aroused due to a perceived gap in current knowledge").

- **Preparation** - This strategy is divided into two complementary stages: Presentation of "Program and Objectives" and "Contextualization and Activation":

- a) **Program and Objectives** - Presentation of the program, objectives and what is expected of the student (Cf. - Gagné's second event "Informing the learner of the Objective"; Keller's second principle: "Motivation to learn is promoted when the knowledge to be learned is perceived to be meaningfully related to one's goals").

- b) **Contextualization and Activation** - This strategy seeks to make an introduction, a contextualization or a reminder of the subject so the student can activate prior existing knowledge (Cf. - Gagné's third event Stimulating Recall of Prerequisite Learned Capabilities; Merrill's Activation principle).

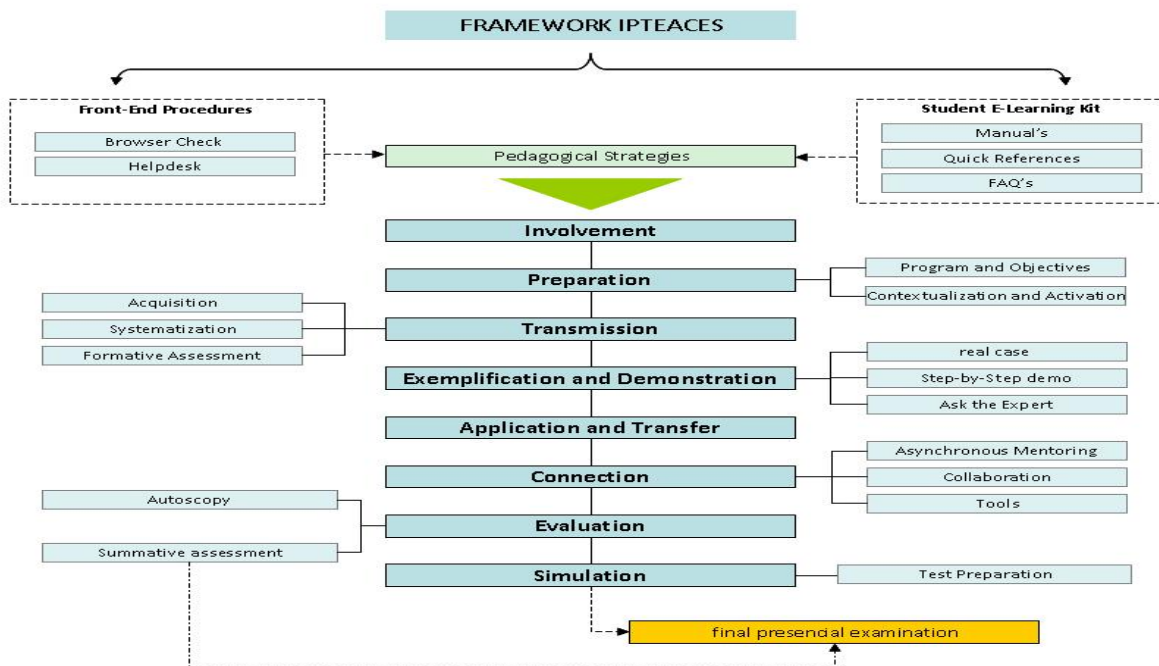


Figure 1: The IPTEACES Framework – Prepared by the Third Author

- **Transmission** - This phase is divided into three complementary steps: Acquisition (learning content), Systematization and Formative Assessment.

Acquisition is the central strategy for presenting the learning content of the course. This strategy (Gagné's fourth event presents the Stimulus Material) is where the new content is actually presented to the learner. After presenting a part of the new material, it is advisable to carry out systematization through a recapitulation of concepts and ideas taught. It is also desirable, at the end, to create a graphical representation of the relationship between the concepts and ideas (new learning material) through the use, for instance, of "concept maps" or "dynamic diagrams." In order to inform the learner if s/he has understood and has achieved the objectives, s/he should be presented with an exercise or a set of questions in a formative assessment before proceeding to the next phase of the course.

- **Exemplification and Demonstration** - This phase is mainly based on Merrill's (2002; 2007) "demonstration principle" and is divided into three complementary sub-strategies: Real Case, Step-by-Step Demo and Ask the Expert.

a) Real Case is an exemplification based on real cases and real situations and presents learners with authentic real-life situations, while illustrating the relevance of the content and demonstrating the concepts learned.

b) Step-by-Step Demo is a type of guided exemplification (Cf. Gagné's fifth event providing learning guidance) that decomposes a problem into phases and components and demands a detailed analysis of and commentary on the parts that constitute a complex situation or problem.

c) Ask the Expert phase presents the student with a more complex situation, a structured example which may require the student to ask advice, in some areas of the course, from an expert on how the problem could be resolved.

- **Application and Transfer** - This phase is an effort to maximize the transfer of learning, by requiring students to flexibly apply what has been learned in new or unfamiliar situations (Cf. Gagné's fifth and sixth event – Eliciting learning guidance and Providing feedback; Keller's third principle Confidence and Merrill's application principle - Learning is promoted when learners engage in the application of their newly acquired knowledge or skill that is consistent with the type of content being taught).

- **Connection** - This phase focuses on mentoring, collaboration and tools.

a) Asynchronous Mentoring - We developed for the course an integrated e-mail functionality enabling students to question their tutor. Each screen has a specific code for unique identification.

b) Collaboration: two kinds of discussion forums are available: Supervised discussion forums and peer discussion forums.

c) Tools: This feature gives the student access to a glossary of terms, job aids, documentation, worksheets, etc.

- **Evaluation: Self-Assessment and Summative evaluation** - At the end of each learning module, the system suggests that the student submit a Self-Assessment. The intention is to determine whether the student, in his/her opinion, has achieved the learning objectives.

Upon completing the modules, students are required to undertake a final assessment. This test, a summative evaluation, is intended to assess objectively whether the student has achieved the specific objectives of each of the learning modules. A detailed feedback follows the results of the summative assessment. Students can see their classification (score); note the questions that are correct or incorrect; compare their answer with the accurate response. This process creates a direct learning path that addresses any gaps in the learning.

This strategy relates directly to Gagné's eighth event, Assess Performance, and to Keller's fourth principle "Motivation to learn is promoted when learners anticipate and experience satisfying outcomes to a learning task" – which is represented in the ARCS model by Satisfaction. It is necessary for learners to have positive feelings about their learning experiences and to develop continuing motivation to learn.

- **Simulation** - A simulation exam was devised similar to the one that the candidates need to pass in the face-to-face examination after successfully completing all the e-learning modules. This strategy takes into account Gagne's ninth event (Enhance retention and transfer to the Job) and especially Merrill's Integration Principle - Learning is promoted when learners integrate their brand new knowledge into their everyday life by being directed to reflect on, discuss, or defend their new knowledge or skill.

#### **4. IS6 AND WSPD UNITS; UNIT PROGRAM AND ASSESSMENTS**

The IS6 unit was developed based on the second researcher's PhD research and results, the Te'eni, Carey, Zhang (2007) textbook, and an up-to-date literature review of journals, e-journals, books and e-books to ensure that up-to-date knowledge and cutting edge learning is delivered to the students to promote and enhance their understanding of the design and development of successful, effective devices/interfaces and websites by implementing HCI and Usability principles and guidelines. The unit program comprises the following topics: physical, cognitive and affective engineering; evaluation; task analysis; colour; navigation; prototyping; HCI methodologies; social networking and a new topic was introduced is sustainable design. As indicated previously, to convey the same principles as those in the IS6 unit, the third researcher is currently running the IS6 unit in his university as the WSPD unit (see Table 1).

To facilitate student learning about the features of HCI and Usability presented in the IS6 and WSPD units, students must complete the following assessments: 1) mini-tests, reflective journal and contribution to a group discussion forum using Blackboard and Moodle. These assessment methods are carefully chosen to develop students' skills of reflective and critical thinking, writing, reading and presentation skills, teamwork and leadership, debating, collaboration and communication and endnote software skills (see Figure 2).

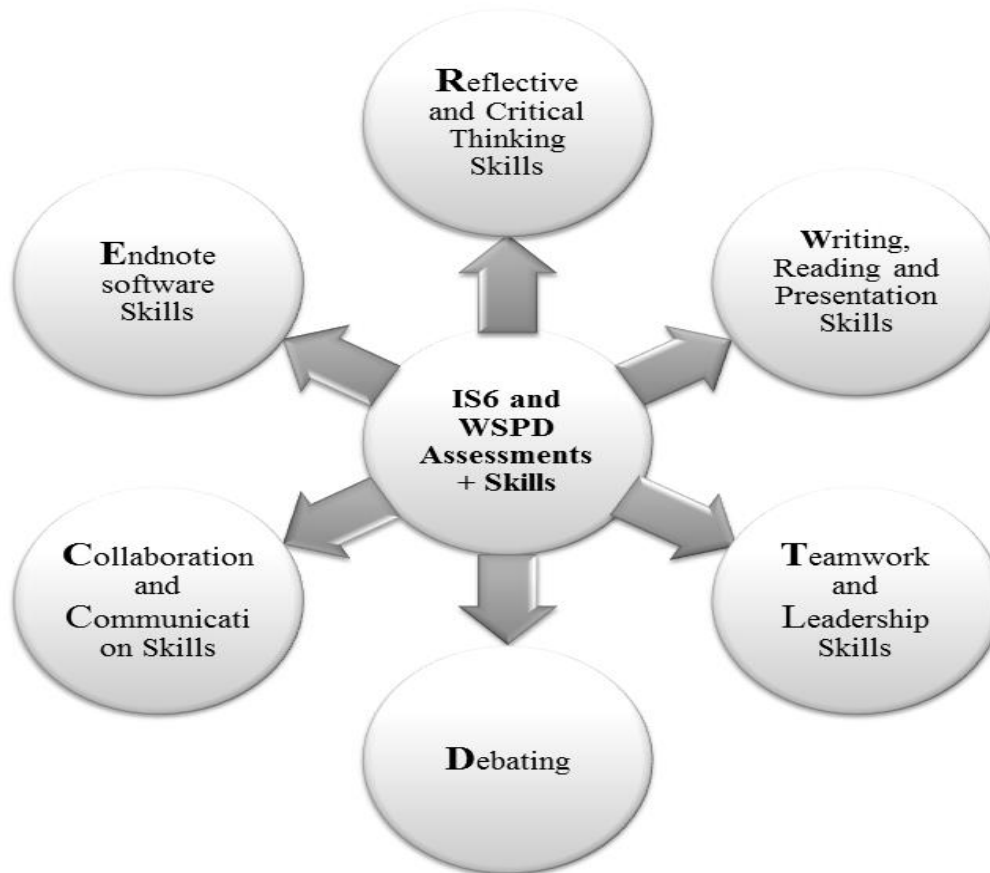
The first mini-test consisted of questions intended to encourage middle- and high-level thinking (15 multiple-choices short-answer questions based on lecturers' notes and the case study). The case study was mainly aimed at the

students' high-level thinking, as they were required to identify the website's problems and modify it according to the principles and guidelines of HCI. The second mini-test was an open-book exam moving away from memorization into application; this too targeted students' high-level thinking. The second mini-test comprised four questions intended to ascertain students' understanding of the articles at hand, for which they presented their perspective as a report. The second assessment was the reflective journal assessment, designed to provide students with experience in critically, creatively and reflectively reviewing and recording the key points from and their thoughts about material from textbooks, journal articles, and the Internet. In addition, this assessment encouraged students to keep up to date with their readings and visits to WWW sites related to the unit. Students were urged to include more than just a summary of the articles in this journal, moving beyond to include their own reflections of the reviewed material. Students were required to include in these reflective journals evidence from multiple sources. Furthermore, to encourage teamwork skills, some journals

were completed as a group project, and later each group member presented his/her contribution to their colleagues as an oral presentation. The Skills and Communications Centre at Curtin School developed the journal template which was divided into six sections: 1) full bibliographical reference, 2) the subject/theme of the article, 3) the author's contention 4) a comparison of the author's views with those of other authors on the same or similar topics, 5) student's own thoughts regarding the subject, and 6) conclusion. For the reflective journal assessment (Journal 7), the second author developed the reflective journal template. This template was divided into three sections: 1) What did you learn from these journals? 2) What did you learn from this unit? 3) Your Perspective/reflection and any recommendations. The third assessment was based on the contribution to group discussions – Blackboard. Students were expected to contribute actively to the group discussion using Blackboard. Contributions were intended to reflect their understanding of the material provided. The mark allocated was based on both the quantity and quality of the material presented by each student.

Unit/Program	Assessment	Exercises during the class	Relevance to the IPTEACES
<b>Introduction, Organizational and Business Context</b>		Writing a sample reflective journal based on the journal template -	Involvement Stage
<b>Interactive Technologies and Physical Engineering</b>		Exercise/Presentation: identify the HCI and Usability problems in mobile phones and develop a new mobile phone based on the unit theory and student's needs.	Preparation Stage
<b>Cognitive Engineering and Affective Engineering</b>	Reflective Journal 1 (Individual Assessment)	Exercise/Presentation: identify the problems in bad interfaces and redesign the interfaces to ensure that Usability and HCI are available in your design.	Preparation Stage
<b>Evaluation</b>		Exercises regarding emerging HCI technologies, effective expressions, as well web accessibility guide.	Preparation Stage
<b>Design Principles and Guidelines</b>	Reflective Journal 2 (Individual Assessment)	Exercise/Presentation: identify the problems in search engine websites based on design principles and guidelines. As well develop concept maps based on the exercise findings	Transmission Stage
<b>Tasks in the Organizational Context</b>	Reflective Journal 3 (Team Work)	Exercise/Presentation: developing and designing interfaces based on real case studies	Exemplification
<b>Componential Design</b>	Reflective Journal 4 (Team Work)	Exercise: developing and designing interfaces based on real case studies	Exemplification
<b>HCI Development Methodology</b>	Reflective Journal 5 (Individual Assessment)	Exercise/Presentation: developing and designing interfaces based on real case studies using HCI development methodology	Exemplification
<b>Social and Global Issues, Web 2.0 and web 3.0 Meeting the Changing needs of IT Development and Use</b>	Reflective Journal 6 (Individual Assessment)	Exercise: identify the problems in Web 3.0 websites based on design principles and guidelines	Exemplification
<b>Sustainable Design</b>	Journal 7 (Final Reflective Journal)	Exercise: reflective journal based on journal template, about sustainable design	Application and Transfer stage

**Table 1: Unit/Program for IS6 and WSPD units**



**Figure 2: Assessment Skills for IS6 and WSPD – Prepared by the authors**

These skills (see Figure 2) are essential for university life and the demands of the workplace in the future. A series of recommendations is made to ensure that the completion of this unit at the university level will achieve several benefits, including: understanding the principles and guidelines of Usability and HCI, which are required in order to develop websites successfully, analyzing and synthesizing journal articles and publications and providing a literature review to identify the gaps in the literature; improving students' communication and personal skills, and aligning the unit, degree and university aims and objectives.

The units' assessments and syllabus are designed to develop the personal and academic attributes that are desirable in a university graduate (see Figure 3). In 2013, slight modifications will be made to the assessment approaches; the three modes of assessment will be: Final Test (Individual Assessment) 40%; Reflective Journal (3) – 30% and finally, Wiki – 30%.

## **5. PARTICIPANTS**

This study focused on two postgraduate units in Australia and Portugal: the IS6 unit in Australia and the WSPD unit in Portugal. The 27 participants are mainly from Asia (including India), Europe, the Middle East, America (North and South) and Africa. A mixture of different nationalities and cultures plays an important role in these units, as each participant

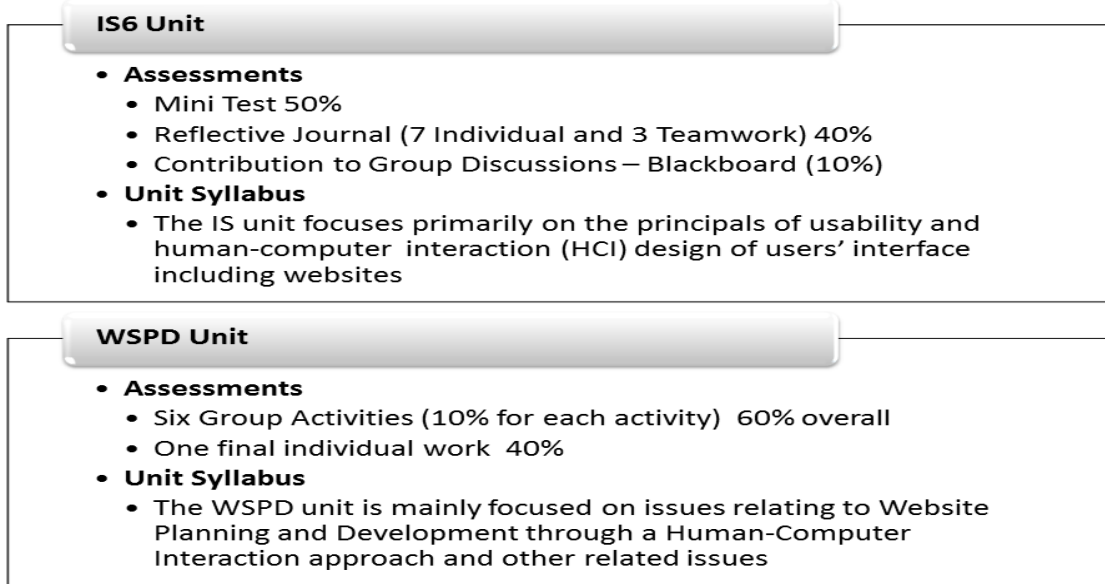
interacts and shares his/her knowledge and skills, experience, and cultural perspective with their colleagues in person or via online discussion. The participant group comprised 14.8% females and 85.1% males. The researchers noted that both genders took equal part in various activities, including discussions, debates, presentations, teamwork activities, and the exchange of ideas. Table 2 provides the demographic details of the IS6 and WSPD students for the 2011-2012 periods.

## **6. RESEARCH METHODS AND QUESTION**

This study aims to examine whether the use of the IPTEACES framework, especially with regard to assessments, will enhance students' understanding of the concepts of HCI and Usability in the development process including websites. This study provides experimental evidence based on quantitative and qualitative data derived from three sources: online survey, informal and formal students' feedback from 27 student evaluations of and attitudes to the IS6/WSPD units (respectively at Curtin University and at Universidade Aberta). Both informal and formal feedback was collected during the semester to report students' perceptions of the learning experience at the university, including feedback about the unit and the teaching. The first method is Informal feedback, which is a teaching and learning innovation. During week four of the semester, students are asked to provide their

anonymous feedback regarding the unit structure, layout and assessments via an online survey. This feedback assists the lecturers to enhance/improve their teaching of the unit before the end of the semester. The second method is formal feedback

which is collected at the end of the semester through the university's formal feedback process. Students have the opportunity to provide feedback anonymously on their learning experiences and on the unit and teaching evaluation.



**Figure 3 Assessment Activities for Postgraduate Units - Australia and Portugal (2011 – 2012)**

Unit	Students #	Gender		Asia (Including India)	Europe	Middle East	America (A) /North (N) and South (S)	Africa
		Female	Male					
IS6	15	2	13	9	0	4	1 (SA)	1
WSPD	12	2	10	0	9	0	1(SA)	2
<b>Total</b>	<b>27</b>	<b>4</b>	<b>23</b>	<b>9</b>	<b>9</b>	<b>4</b>	<b>2</b>	<b>3</b>

**Table 2: Postgraduate units Participants – Australia and Portugal (2011-2012)**

Finally, the third method is the online survey. This survey is divided into five parts. The purpose of each part of the survey was explained to students. The first part pertains to background information such as participant's level of formal education, main field(s) of study, and gender. Part two aims to examine students' reactions to the unit's program; part three is intended to evaluate students' attitudes to the units' assessment approach; part four seeks students' perception of the lecturer's feedback on the various methods of assessment,

including the reflective journals, exam and the discussion board. Finally, part five is intended to ascertain whether students' skills (oral presentation, writing, reading, critical thinking, research and search, use of the Endnote software, collaboration and communication) have improved after completing the IS6 and WSPD units. In the following section, the researchers discuss the results from part five of the survey. The authors used a five-point Likert scale ranging from "Strongly disagree" to "Strongly agree" for parts two to five.

Besides using the Likert five-point scale for this survey, the authors provided a section where students could write down other comments regarding each part.

**7. RESULTS**

To confirm the study’s aims and objectives, this section presents the results from the informal and formal feedback as well as the survey. It was noted from the informal feedback (see Table 3) that students were satisfied with both the lectures (classes) and lecturer (instructor) for both the IS6 and WSPD units.

The informal feedback indicated that students believed that their lecturers had a good knowledge of HCI and Usability concepts, and that the classes were engaging and not boring as lecturers used a wide variety of teaching approaches in their classes. Furthermore, students were very complimentary in their comments about the units’ materials, program, and assessments:

*Feedback was given for every assignments submitted*  
*Website evaluation – Hands on assignment/ activities that help us understand more/in depth regarding to usability*  
*Real world and up-to-date methodologies/concept*  
*Pushing students to perform a lot of readings to improve our reading skills*

Year	Unit	Question	Strongly Disagree/Disagree	Neutral	Agree/Strongly Agree
2012	IS6	I am satisfied with the Lectures (Classes)	1	1	11
		I am satisfied with the Lecturer (Instructor)	1	1	11
2011	WSPD	I am satisfied with the Lectures (Classes)			10
		I am satisfied with the Lecturer (Instructor)			10

**Table 3: Students Informal Feedback – IS6 and WSPD**

The IS650 and WSPD Units Program	Mean		SD	
	Australia	Portugal	Australia	Portugal
Match my expectations	3.9	4.33	0.57	0.71
Assist me to obtain new knowledge in respect to HCI and Usability concepts	4.7	4.56	0.48	0.73
Assist me to evaluate and access websites and interfaces	4.2	4.67	0.42	0.5
Allow me to understand the design principles and guidelines for developing an interface and websites	4.3	4.63	0.48	0.52
Allow me to understand the difference between evaluation and testing stages in web development process	3.9	4.22	0.57	0.83
Allow me to understand the concepts behind color, navigation and prototyping	4.4	4.44	0.52	0.88
Allow me to understand the principles behind social networking including Web 3.0	4	4.13	0.67	0.83
Allow me to learn new concepts i.e. sustainable design of new devices	4.2	4.44	0.63	0.73

**Table 4: Program Unit – IS6 and WSPD units (response rate IS6 =91%, WSPD =90%)**

The above feedback confirmed that students were pleased with the IS6 and WSPD units’ materials, program, assessments as well the formative and quickest lecturers’ feedback, as all play a major role in improving their learning journey. Moreover, via the formal feedback, students

confirmed that their lecturers have the necessary knowledge and skills to teach IS6 and WSPD. The following comments are indicative of the students’ positive attitude towards their lecturers and lectures:



*Zealous Lecturer*

Sharing and inform interesting issues related with HCI, such as usability and satisfaction, using mind map for materials summarizing

Group discussion is really a powerful weapon, learn things quick and it is good to share ideas with each other

Our Lecturer is elaborate and eloquent in explaining ideas - use of practical examples Continue provide us your feedback by using the latest technology i.e. audio feedback (mp3), as well the tracking via Microsoft Word

The researchers administered an online survey to examine student’s attitudes and opinions regarding the IS6 and WSPD units. The survey elicited students’ views on program units, assessments, and teacher feedback as well the skills that were acquired as a result of completing the IS6 and WSPD units. Table 4 indicates that the current **unit program** meets student’s expectations, as they obtained new skills and knowledge pertaining to HCI and Usability concepts, design principles and guidelines, and the concepts of color, navigation, prototyping, social networking, including Web 3.0 and the new topic, sustainable design.

Students were pleased with the unit program as indicated by the following observations:

*This unit made me perceives how users interact with computer systems differently, not from the interfaces themselves but by the knowledge and thinking that designers undertake before producing those interfaces. First impressions are important it was found, but what constitutes for a good first impression? Aesthetics were a base factor which included layout, colour and font selection. The simplest concept of contrasting colours is often overlooked by many web designers as proven by the badly designed websites presented in class. The use of tools such as Access Colours Website and PowerMapper definitely*

*helped in understanding these concepts. This unit provides a new understanding for me about how user satisfaction is so dominant in the development of a system.*

*The most interesting part of the study is learning about environmental sustainability design and HCI, which is very relevant to the current situation of the world. Due to the problem of global warming, there is a need to raise awareness to the manufacturing companies about environmental sustainability design and HCI and its impact on environment. If this things are not taken care form the initial stage before it is too late, then everyone will face the consequences, it can be very harmful even leading to disaster. As there is saying, “Prevention is better than cure” so it is wise to design environment-friendly product before it is too late. As we tend to learn, more when learning is made more interactive. The most interactive session happens in HCI class and what I felt extraordinary about it is, inviting professional, making them present the real world situation, and sharing their experience in the particular area or field. I feel it is good way of educating and should carry on with such activities and good initiatives.*

In relation to the IS6 and WSPD assessment approaches, students confirmed that most of the **assessments** were well-designed since they acquired several skills from undertaking each assessment task; these skills included: critical thinking, analysis and synthesis of articles, teamwork and communication, and working with real case studies. Finally, students confirmed that these assessment tasks challenged them to complete them on time or earlier. Students’ ratings of the following statements regarding assessments (Table 5) were highly positive.

Majority of the students were pleased with the assessments style, as completing these assessments encourage students to obtain the professional and personal skills for their study as well workforce in the future.

IS650 and WSPD Assessments allow me to:	Mean		SD	
	Australia	Portugal	Australia	Portugal
Develop new interfaces and websites	3.8	4.25	0.42	0.89
Read, analysis and synthesis articles and publications	4.1	4.75	0.57	0.46
Write reflective journals	4.1	4.75	0.74	0.46
Draw concept maps using Visio software or alike	3.1	4.25	0.99	0.89
Work independently and enhance my communication skills	3.9	4.5	0.32	0.53
Enhance my teamwork skills	4.1	4.38	0.57	1.06
Share my knowledge and expertise with my colleagues via face to face or online modes	4.2	4.5	0.63	0.53
Work with real case studies	4.2	4.13	0.42	0.64
Challenge myself and complete my assessments on time	4.2	4.38	0.79	0.52

Table 5: Assessments – IS6 and WSPD units (response rate IS6 =91%, WSPD =90%)

Moreover, several assignments have been adapted with real situation where students required to assess the real issue regarding user interfaces and gave highly recommendation accordingly. With implementing the current real situation and not depends on the academic theory only, the unit has become more mature, adaptable and implementable in the real business environment.

I feel writing journal is good way of learning as we read the articles, then try to understand what it is about, try to find the linkage between different authors view on the subject and then write how different authors were agreeing or arguing on the same topic supporting our own point of view. It is all about giving extra justification to your point of view or your way of thinking by supporting it with the articles and giving additional explanation in order to make your answer justifiable and more meaningful. The benefits of the journals are: Learning experience; Thinking critically; and topic understanding.

Both type of assignments which are individual journals and the team collaborations, each had its own challenge. The individual journals surely brought a lot of information to learn, understanding new ideas and searched for other discussion on same topic. Team collaboration provided opportunity to apply the theories and information from class and journals, also on how to apply effective communication. It is also interesting to use discussion board to share your ideas or ask questions. Websites reviewed based on user analysis and task analysis also provided a more logical result from traditional review.

The lecturers' feedback played a major role in improving the quality of student journals for the purpose of assessment; since the lecturers provided comprehensive, formative feedback on the first journal submitted by students, this helped

to improve subsequent journals as students were able to learn from initial mistakes and avoid repeating them in subsequent journals. Furthermore, this type of feedback allows them to improve a range of skills including communication, effective learning, thinking, writing and presentation – all of which are essential for their current university studies as well as their future careers. Students were generous in their responses to their lecturer's feedback (see Table 6).

One of the good aspects about this unit is that the content is up-to-date and most articles are recent. I believe that the lecturer enthusiasm reflected on students and encouraged them to study and discuss the unit topic. I like the way that the lecturer used different creative methods to approach students i.e. mp3 voice feedback. I believe that my writing skills have been improved dramatically due to writing the weekly journals and applying the lecturer feedback. "Journal 1" mark (3.3/5) and comments were a good indication of my writing skills level and pointed that I need to improve my writing. However, "journal 6" mark (5/5) was an obvious indicator of improvement and I felt that my hard work has paid off. The reason is my lecturer Feedback on assignments; exercises and journal, there are no delays. Use of audio as feedback is interesting, and then you get to know exactly what you meant other than just commenting on an article, keep it up.

Furthermore, the results presented in Table 7 confirm that the majority of students believed that the IS6 and WSPD units improved a range of skills including those of communication, writing, critical review, research, search and collaboration. Although some students were unsure whether their writing and reading skills had improved, they still expressed views regarding the skills which they had acquired by undertaking the IS60 and WSPD units

My teacher feedback in IS650 and WSPD allow me to:	Mean		SD	
	Australia	Portugal	Australia	Portugal
Improve and enhance my next assessment submission	4.5	4.63	0.53	0.52
Prevent repeating the same mistakes for my next assessment submission	4.5	4.75	0.53	0.46
Improve my learning and thinking skills	4.3	4.5	0.48	0.76
Improve my writing and presentation skills	3.8	4.75	0.92	0.46
Gain new knowledge and skills for my university life as well as for future life	4.4	4.38	0.7	1.06

Table 6: Teacher Feedback – IS6 and WSPD units (response rate IS6 =91%, WSPD =90%)

*Time management is another key point that I learnt about, cause of the deadline that was there to submit the journals. I learnt how to work within a given period of time. Group work was amazing, working with people from different backgrounds and getting to know them at personal levels.*

*My writing skills improved tremendously, because of comments from the Unit coordinator about grammar. My ability to communicate to other people was boosted, because of the presentation in class, and being able to share ideas with others. The idea of the class exercise is brilliant as it makes us to interact with one another and get to know our backgrounds, strengths and weakness in relation to our studies. Use of audio as feedback is interesting, and then you get to know exactly what you meant other than just commenting on an article, keep it up. I believe that the journals offered me the opportunity to improve my research skills through locating, reading and analysing articles. Furthermore, my referencing skills have been developed and I have learned to use "EndNote" referencing program.*

## **8. DISCUSSION AND THEORETICAL SIGNIFICANCE**

Developing the assessments for IS6 and WSPD units was a challenge exercise for the lecturers to match the units and master objectives, students' needs as well to meet the implementation of IPTEACES framework. Lecturers developed the assessments bearing in mind the theory behind the unit, as well adding real case studies to the assessments. Students were very pleased with this style of teaching since they managed to add their knowledge and perspective to the assessments behind the theory from the units. The assessments are mainly reflective journals, test as well discussion board. These assessments were selected to develop specific skills among the students from writing, reading, research, search, teamwork, critical thinking, analyzing and synthesizing articles, as well communication and collaboration. These skills were useful for the current study as well for the workforce in the future. As it was indicated previously, that IPTEACES framework is divided into eight stages, namely, Involvement, Preparation, Transmission, Exemplification and Demonstration, Application and Transfer, Connection, Evaluation and Simulation.

At the Involvement stage of the IPTEACES framework, lecturers uploaded several case studies and corporate scenarios to supplement the IS6 and WSPD unit materials. This was intended to motivate and encourage the students to see how theory was applicable to real-world situations. Students read the exercises and tried to resolve the issues presented, individually at first, and later as a team. Students presented their findings in three slides identifying only the problems in the case study, suggesting how the problems could be solved using particular tools or a specific framework, and then presenting the solution. Students confirmed that these exercises were relevant, consolidating their understanding of theory through practical application.

**The Preparation stage** is intended to match students' learning with the objectives of the IS6 and WSPD units. Assessments were designed to align with the objectives and aims of both the unit and the university. Each assessment was developed according to a specific objective in the unit, and

most of the assessments were applied to either individual students or teams in order to develop specific communication skills. For example, the initial preparation and brainstorming for the journal required teamwork within the classroom so that lecturers could ascertain whether or not the students were on the right track by giving feedback that would ultimately improve the final submission. After completing this exercise, if there was still a gap in the knowledge, another exercise was uploaded to the Blackboard asking students either individually or in teams to complete. This was to ensure that students had acquired the knowledge necessary to meet specific unit objectives. By presenting their findings to the class, students were able to share their knowledge, culture and skills, thereby assisting one another in the learning process. This exercise helped students to improve their self-esteem, communication skills and self-confidence. In relation to the **Transmission stage**, to encourage communication between students, the lecturers presented new materials relevant to HCI and Usability. To determine whether students had acquired the necessary knowledge and skills pertaining to the new materials, the students were asked to present (as a team exercise) a concept map based on specific terms which were explained in the lecturer notes. Students presented their findings to the whole class for peer assessment and to obtain feedback from the lecturer.

In the **Exemplification and Demonstration stage**, lecturers asked their students to evaluate the university and department websites to ascertain whether these matched their needs, and later asked them to present their findings to the university's Web Design Manager. It was confirmed that the majority of the changes and findings identified by the students were taken into consideration by the Web Design Manager in the next modification. Students confirmed that this exercise gave them the chance to deal with a real case study and learned how to evaluate and assess websites based on the unit materials. They were able to provide several valuable suggestions to the university on how to improve its websites and meet the students' and university's needs. In the Application and Transfer stage, the lecturers used the assessments of the reflective journals as a means of improving students' problem-solving, decision-making and communication skills. To ensure that students were accurately addressing all aspects of the task and presenting the journal in the correct format, the lecturers provided several formative feedbacks which students used to make changes before the final submission. It was confirmed that this method assisted the students to develop two skills: writing a reflective journal using the journal template, and ensuring that the journal outcomes met the assessment criteria and the lecturers' expectations.

Furthermore, the **Connection stage** of the IPTEACES framework assisted lecturers to improve the communication and collaboration skills of students and lecturers via the discussion board using Blackboard and Moodle. It was noted that the use of this tool in IS6 and WSPD units, allows students to share knowledge and new experience with both their colleagues and lecturers; twice a week, the lecturers checked the discussion tool to provide some guidance and formative feedback on the posting. Students confirmed that the discussion board allowed them to be 'free to express opinions, critical and interactive with the colleagues'.

By completing IS650 and WSPD unit , I have improved my:	Mean		SD	
	Australia	Portugal	Australia	Portugal
Collaboration skills	3.89	4.38	0.93	0.74
Writing skills	3.44	4.75	0.88	0.46
Reading skills	3.67	4.75	0.71	0.46
Critical skills	4.11	4.75	0.6	0.46
Research skills	4.22	4.63	0.67	0.52
Search skills	4.11	4.25	0.6	0.71
Communication skills	3.78	4.25	0.67	0.71

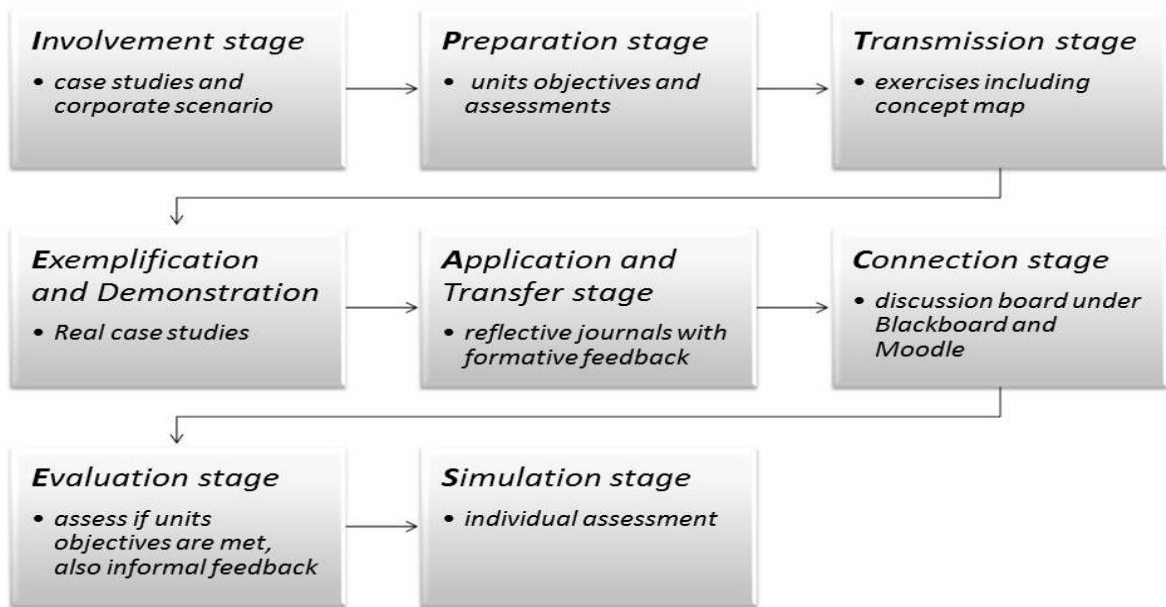
Table 7: Completing IS6 and WSPD units (response rate IS6 =91%, WSPD =90%)

The **Evaluation stage** of the IPTEACES framework is vital in the IS6 and WSPD units, because after each learning model in the program/unit, the lecturers present a case study or self-test (revision of previous lectures using multiple-choice questions), to ascertain whether the learning objectives have been met. This exercise was useful, as the majority of students indicated that it ‘help(ed) students to share their ideas with other students who provide a learning curve’. The evaluation was not limited to the learning model as the lecturers asked students to provide some informal feedback regarding the whole unit, including the assessments and lecturers’ feedback; this feedback assisted lecturers to identify any problems in the units before the end of the semester in order to make changes based on the students’ feedback. The implementation of the Simulation stage proved to be a challenge for both lecturers and students. The second mini test was an open-book exam with a shift from memorization to application, thereby targeting students’ high-level thinking. The mini test consisted of 2-3 questions based on students’ understanding of the articles at hand, presenting their account in a report. The majority of students indicated that this style of response was more popular than the short-answer type of responses. Indeed, this provides students with the opportunity to include their own perspective and experience in addition to what they learned from the material provided.

By implementing the IPTEACES framework in IS6 and WSPD units, especially with regard to the assessments and class exercises, the lecturers were able to achieve the objectives of the unit, the Master degree, and the university, as well as meeting the students’ needs. Figure 4 illustrates the IPTEACES stages matching the assessments and lecturers’ actions in IS6 and WSPD units.

Finally, the adoption and implementation of the IPTEACES framework in IS6 and WSPD assessments was an interesting and challenging experience for both of the lecturers. The assessments helped lecturers and students to better understand the HCI and Usability concepts. Moreover, students improved their communications skills, which are required for the current study as well as for the workforce in the future. In the end, this proved to be a win-win strategy for all concerned. Upon completing the unit, students were generous in their positive feedback about their lecturers. Below is one typical comment:

*There is a lot of interaction in the class which is really good. You speak with a lot of knowledge in class, very energetic and enthusiastic about the course, which makes the class enjoyable to be in. I personally think you are doing great job. You’ve been helping us a lot, very interactive, knowledgeable, goal-oriented, creative, committed, unique, industrious and fun to work with.*



**Figure 4: IPTEACES stages matching the assessments and lecturers action in IS6 and WSPD units.**

## 9. LESSONS LEARNED

Integrating and implementing IPTEACES framework in IS6 and WSPD, especially in the assessments, was a challenging exercise for both the lecturers and the students, as the lecturers choose the assessments based on unit objectives, the requirements of a Master degree, and the students' needs. Each assessment was developed to match the specific objectives of the unit, and to develop students' skills in reading, writing, and critical thinking, to name a few. However, to ensure that these assessments run smoothly without any glitches, a formative feedback approach was adopted by the lecturers in order to tackle any problems immediately and improve the presentation, structure and design of the assessment. At the same time, students were keen to take this feedback into consideration to improve their submissions. Moreover, from the lecturers' perspective, regular feedback prevents students from repeating the same mistakes and improves their learning behaviour and thinking skills, especially concerning report writing, research, and using endnote software. The integration of diverse types of assessments in a unit, especially in higher education, allows students to develop various skills and makes their studies more enjoyable and pleasant, since communication and collaboration among students will increase their levels of satisfaction with the teaching and learning experiences, as one of our students confirms: 'I will say I really enjoy this unit and spend great time on every Tuesday night ☺'. On the basis of the literature review and students' feedback (Loughran, 2002; Lynch, McNamara, & Seery, 2012; Moody, 2002; Odrakiewicz, 2010 ; Titus & Gremler, 2010; Zamorano, Rodriguez, Ramos-Ridao, Pasadas, & Priego, 2010; Zhao, Valcke, Desoete, & Verhaeghe, 2012) the researchers definitely recommend the integration and implementation of the IPTEACES framework in higher-education units, since

this framework will assist lecturers to format, organize and plane the assessments to promote and enhance student teaching and learning, not only in for higher education but as well for the workforce, since businesses seek graduates with good communication skills including interpersonal interaction, negotiation, conflict resolution, listening, and patience with others, and competence in the areas of leadership, brainstorming, research, writing, problem solving, and decision-making. Finally, on the basis of the students' outstanding overall satisfaction, the first researcher is now considered as a teacher-leader in developing assessments in the school, and she now works with her colleagues to support and implement assessments in the school curriculum strategy to foster the attributes desirable in a university graduate and to promote and improve students' learning skills.

## 10. LIMITATIONS

The rationale for this study was to examine whether the use of the IPTEACES framework, especially in the assessments, will enhance students' understanding of the concepts of HCI and Usability in the web development process in IS6 and WSPD units. This study was undertaken as a research project by two lecturers in Australia and Portugal with small size sample, as a pilot study. In future, further research will be carried out to test the IPTEACES framework in other postgraduate units and compare the results with the current study from Australia and Portugal. Further research with larger and diverse groups of students is required in the future to strengthen the research aims and objectives.

## 11. CONCLUSION

This study investigated the incorporation of the IPTEACES framework in IS6 and WSPD units, particularly for

assessments at the postgraduate degree level in the higher-education sector. The study substantiated the significance of IS6 and WSPD assessments, since students confirmed that their collaboration, cooperation and communication skills, which are essential and significant for the lifelong learning process and future workplace, improved. This study examines how the IPTEACES framework can assist lecturers to more efficiently develop, plan and organize the assessments, make the teaching and learning process more rewarding and pleasant for students, and develop in their students the necessary skills and knowledge required for both their current studies and future careers. Furthermore, by providing formative feedback to students, the lecturer can address any problems immediately, thereby improving future presentations and preventing students from repeating the same mistakes. Moreover, this assessment strategy improves students' critical thinking, self-confidence and learning behaviour. Another advantage is that students are motivated to complete tasks punctually according to the team's agreement. Furthermore, it was confirmed that students improved their communication skills, including interpersonal interaction, negotiation, conflict resolution, listening, and patience with others, and their skills in the areas of leadership, brainstorming, research, writing, problem solving, and decision-making. Finally, this study recommends that the IPTEACES framework should be implemented in higher education to meet the needs of students, university and the workplace, since this framework, especially in terms of the assessments, allows students to develop the essential skills needed for their current studies and their future place in the workforce. The researchers intend to conduct further research to test the IPTEACES framework in other postgraduate units and compare the results with those of the current study.

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#### **AUTHOR BIOGRAPHIES**

**Pedro Isaias** is an associate professor at the Universidade Aberta (Portuguese Open University) in Lisbon, Portugal, responsible for several courses and director of the master degree program in Management / MBA. Was director of master degree program in Electronic Commerce and Internet since its start in 2003 until July 2014. He holds a PhD in Information Management (in the speciality of information and decision systems) from the New University of Lisbon. Author of several books, book chapters, papers and research reports, all in the information systems area, he has headed several conferences and workshops within the mentioned area. He has also been responsible for the scientific coordination of several EU funded research projects. He is also member of the editorial board of several journals and program committee member of several conferences and workshops. At the moment he conducts research activity related to Information Systems in general, E-Learning, E-Commerce and WWW related areas. Pedro Isaias is an Adjunct Professor at School of Information Systems – Curtin University, Australia.



**Nuno Pena** is the Director of UnYLeYa (LeYa Group – LeYa). Before that he was the Chief Learning Officer of Portuguese Association of Insurers and founder of the “Portuguese Insurance Academy”. Nuno is also a Postdoctoral Researcher at ADVANCE Research Center of ISEG - School of Economics and Management (Technical University of Lisbon), Researcher at UIED - Education and Development Unit - Faculty of Sciences and Technology, New University of Lisbon (Universidade Nova de Lisboa) and Reviewer in some Academic Journals. He holds a Ph.D. in Information Management, a Master degree in Multimedia Educational Communication from Portuguese Open University (Universidade Aberta); a Postgraduate certificate in Education (PGCE) and a Bachelor in Philosophy from New University of Lisbon (Universidade Nova de Lisboa).



**Tomayess Issa** is a senior lecturer at the School of Information Systems at Curtin University, Australia. Tomayess completed her doctoral research in Web development and Human Factors. As an academic, she is also interested in establishing teaching methods and styles to enhance the students’ learning experiences and resolve problems that students face. Tomayess Issa Conference and Program Co-Chair of the IADIS International Conference on Internet Technologies and Society and IADIS International Conference on Internatiaonal Higher Education. Furthermore, she initiated the IADIS conference for Sustainability, Green IT and Education. Currently, she conducts research locally and globally in information systems, Human-Computer Interaction, Usability, Social Networking, Teaching and Learning, Sustainability, Green IT and Cloud Computing. Tomayess participated in a couple of conferences and published her work in several peer-reviewed journals, books, book chapters, papers and research reports. Tomayess Issa is a Project leader in the International research network (IRNet-EU (Jan2014 – Jan- 2016)) for study and development of new tools and methods for advanced pedagogical science in the field of ICT instruments, e-learning and intercultural competences







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ISSN 1055-3096