

Development of Self Access Internet Based English Module to Support Student Centred Learning (SCL) of Engineering Education

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Abstract

This study describes the development of a self access internet based English module to support Student Centred Learning (SCL) of Engineering Education. The study presents two out of three cyclical stages of a developmental research approach, the Needs Analysis and Design and Development of the module. The learners' need was determined from 63 engineering undergraduates learning styles and used in information presentations and selections of learning activities for the module. The module development was structured according to ADDIE Instructional Design Model. Three learning theories, behaviourist, cognitivist and particularly constructivist were used in designing the module User Interface (UI). The integration of technology to foster learners' active engagement in SCL environment implicates a concrete need of ESL educators' technological competence; thus, an emphasis on technology driven continuous professional development is advocated.

Keywords: student centred learning, interactive module development, learning theories, learning styles

1. Introduction

The use of technology in language learning is evolving significantly at tertiary education levels. Saltmarsh, Sutherland-Smith and Kitto (2008) state that ICT integration earmarks a feasible focus of learning that centralises on learners' active engagement in the ever expanding 'technological society' at higher institutions. Advances in learning technologies have resulted in a ceaseless search for more effective and applicable methods of instructions specifically in meeting learners' diversity in learning. The diversification of learners' learning styles have had many higher education institutions to rethink of their teaching methods and sought innovations (Ladson-Billings, 2001) particularly ones that technology integrated (Dobbins, 2009).

In the context of this study, the implementation of student centred learning (SCL) in engineering education is viewed as an impetus to the changing of educational model (Finelli, Klinger & Budny, 2001). Dym (1999) asserts that SCL aims to appeal to learners' interest to study engineering and sustain in the programme. The approach calls for strategies and tools adoptions using multiple perspectives to better understand complex engineering education problems in engaging future engineers to the profession. Especially at English medium universities that offers interdisciplinary programmes, the task places greater challenges to ESL educators in devising "effective engineering instructional development and the uptake of educational innovations" (Adams, Evangelou, English, Dias de Figueiredo, Mousoulides, Pawley, Schifellite, Stevens, Svinicki, Trenor & Wilson, 2011: p.74) such as the integration of Information and Communication Technology (ICT) in education. On the basis of these precepts, the development of an interactive multimedia module in teaching the language to engineering learners is sought. It also builds on the premise that pedagogical activities should be responsive to learners' needs (Eslami, 2010; Hutchinson & Waters, 1987) and the centric of this need in this study, is learners' learning styles.

This study aims to support SCL in the teaching of UHL2312 Technical English Communication course at Universiti Malaysia Pahang (UMP) using a multimedia interactive module that the researchers developed and

known as 'TEMI'. The development is an effort to increase UMP undergraduates' student learning time (SLT) of the language who are dominantly from engineering field. The initiative is crucial to the language educators and researchers involved as it serves as a valid measurement of students' outside classroom learning time spent. This is to verify the utilisation of 56 hours (14 instruction weeks x 4 hours) in totality of language learning in a semester allotted for the course as documented in its teaching plan, approved and accredited by Malaysian Quality Agency (MQA) and Engineering Accreditation Council (EAC). Thus, the design and development of TEMI is guided by the following research questions.

- 1) What are the learning styles of UMP learners enrolled in English for Technical Communication course?
- 2) How does the development of TEMI depict the learning theories of behaviourism, cognitivism & constructivism principles?
- 3) How does the development of TEMI accommodate the learners' learning styles?

1.1 Learning Styles

Accommodating to learners' learning styles is one of the needs that can be challenging because "it is a biologically and developmentally imposed set of personal characteristics that make some teaching and learning methods effective for certain students but ineffective for others" (Finelli, Klinger & Budny, 2001: 493). It has led to the development of various learning styles models which include the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), Kolb's Learning Style Model (Kolb, 1984, 1981), the Felder-Silverman Learning Styles Model (Felder, 1993), the Dunn and Dunn Learning Styles Model (Dunn, 1990) and the Honey and Mumford four dimensionalities of Learning Styles (Honey & Mumford, 1992).

Augmented with the burgeoning importance of learner-centredness in learning especially in science and engineering education, several educators have embedded a learning styles model in their pedagogical approaches (Case & Light, 2011). The practice works on the basis that in promoting effective learning, it is crucial that the activities to be exercised appeal to learners' learning styles preference. Therefore, this is where our argument and the embarkment of TEMI lies.

1.2 The Learning Theories for Student Centred Learning (SCL) Approach

Discussions on Students Centred Learning (SCL) enhancement via multimedia appropriate a credible connection with the behaviourist, cognitivist and constructivist learning theories (Affendi Hamat, 2009; Ally, Anderson & Elloumi, 2004). The learning theory of behaviourism underlies the notion of feedback for confidence building and increased motivation in learning when learners are conferred with positive approval and support (Mullen & Tallent-Runnels, 2006). The theory also asserts SCL classroom practices that promote learners' autonomy and social relatedness (Alm-Lequeux, 2004) as an integral part of learning, propagates the learners' involvement in their learning process to ensure quality learning (Catalano & Catalano, 1999).

In the case of cognitivism which has long dominated second language acquisition (SLA), the tenet of SCL is very much in line with the mental schemata concept proposed by Roger Schank (1977) (Catalano & Catalano, 1999). The theory exerts the concept of learning that posits the level of mental activity to understand human social action particularly the intentional one in deriving to a meaningful learning (Bordwell, 1989). SCL approach is known to facilitate this knowledge organising process where the emphasis is on how learners perceive, interpret, store and memorise information (Atkinson, 2010).

Constructivism in turn, is probably the strongest theory discussed in this study with regard to SCL approach. The constructivist approach which among the prominence, derived from Piaget (1970), Blumer (1969), Kuhn (1996), von Glasersfeld (1989) and Vygotsky (1978), proposes human beings' constant construction of knowledge through interactions with the surrounding (Hoic-Bozic, Mornar & Boticki, 2009). The philosophical and epistemological assumptions of this theory involve building of new schemata which is garnered through various activities or experience to achieve balance. These balancing processes are performed through accommodation and assimilation of new knowledge which is formed by fitting new information together with what learners already know and co-relate it with the old schemata. This permits and facilitates learners to learn inductively through discovering new things on their own. By opting constructivism method of learning, learners are actually lurked, discovered and ascertained contents, experimented hypotheses and built up knowledge in depth.

Two most leading paradigms in constructivism, the personal constructivism and social or sociocultural constructivism (Jones & Brader-Araje, 2002; Phillips, 1995; Rovai, 2004) are found to be relevant in developing the module. Both are useful in describing in depth understanding within individual learners as well as knowledge construction in communities of practice through social interaction (Fosnot & Perry, 2004). This relates the importance of the theories in scaffolding learning of the language based on learners' individual needs and also

styles of learning. The theories encourage learners to make choices how they prefer to learn, restructure and reform surroundings according to their physiological and cognitive needs. In other term, it warrants self-regulation in learners' learning orientation toward the language and given a period of time is likely to boost learners' confidence (Vrasidas, 2007) and SLA. Constructivism allows learners to construct knowledge individually and through 'activity, reflection and conversation' with their peers and the teachers (Reiber, 1994). For that, constructivism is in trajectory with SCL approach.

In keeping view with the theories particularly constructivism, multimedia courseware application has been found to be eligible in promoting a learning environment that is relaxing, comfortable and conducive for ESL learners SL and knowledge construction that encourages individual exploration through experimentations or reorganisation and in depth comprehension (Azwin Arif Abdul Rahim, 2006). Hence the development of multimedia in SCL is seen as the next step forward by the researchers, to consolidate the theories mentioned, in relation to SCL in the classroom. As such, it is anticipated that the development of TEMI supports the increased in learners' quality learning time (SLT) so as the proliferation in learners' SLA.

1.3 Student Centred Learning (SCL) Approach in Multimedia Interactive Module Development

The technological boom of the 20th century has its widespread effects in language education particularly in aegis of SCL approach. With the advent of technology, the learning environment has become more flexible and adaptive with learners' learning styles. Parallel with technological expansion, SCL approach has seen the shift from the traditional classroom teaching approach which centres on teachers to learners in becoming actively engaged in learning (Warschauer, 2002). A combination of a computer-enhanced and SCL environment serves as a medium to transform language learning practices that can afford greater responsibility and commitment among learners and teachers involved. It even creates a deeper understanding when learners undergo thorough exploration of the learning contents and activities and enhance their critical thinking and problem solving skills (Tynjälä, Salminen, Sutela, Nuutinen & Pitkänen, 2005). The centrality on learners' approach with the emphasised on learners' learning styles preference in learning the target language deems to steer toward an effort to improve learners' perception and satisfaction (Ellis, Ginns & Piggott, 2009) that has been identified to exhibit a connection with learners' cognitive load (Bradford, 2011).

2. Methodology

The development of this prototype runs on 3 stages i.e. needs analysis, design and development and implementation and evaluation of the module as what is determined in a developmental approach (Plomp, 2007). The development employs ADDIE Instructional Design Model (Figure 1) to convert printed learning materials (module) to a multimedia interactive module. The study is a report on the second stage of the developmental approach where the concern is on the design and development of TEMI Developing Multimedia Interactive Courseware using j Query based the learners' learning styles and the three learning theories.

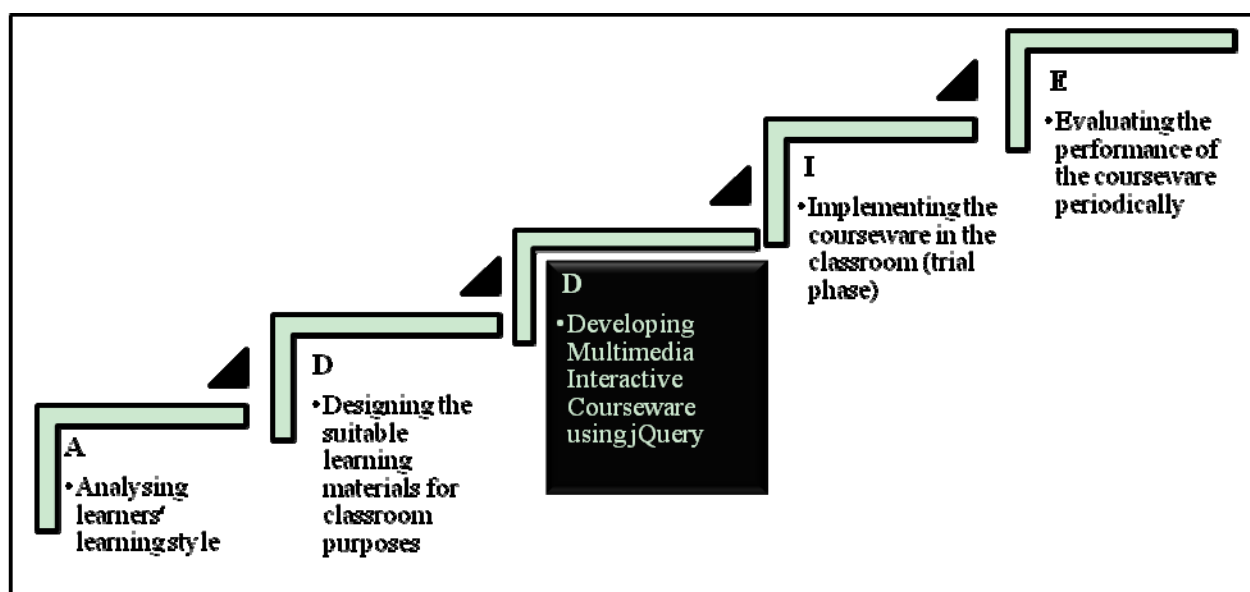


Figure 1. ADDIE instructional design model in developing TEMI

Another concern is on the validity, practicality and effectiveness of the module cum prototype. It is important to note that TEMI prototype is a transformation from printed module to a multimedia medium. Hence, validity was no longer in question. This on-going research will measure the practicality and effectiveness of the module at the end of the research (at the Implementation and Evaluation stage, according to the ADDIE Model) (See Figure 1).

The instrument used in this study was Honey & Mumford Learning Styles Model. It is used in finding out the learners' learning style preferences (Research question 1). Honey & Mumford Learning Styles Model was chosen because it has four stages of learning cycle that helped the researcher in varying the types of activities planned and designed in TEMI. The learning styles model consists of four dimensionalities learning styles namely Activist, Theorist, Pragmatist and Reflector (Honey & Mumford, 1992).

In relation to the second research question 2, the development of the TEMI prototype has embedded all the principles of behaviourism, constructivism and cognitivism. The principles were illustrated in the design of TEMI user interface (UI). The learners' learning styles data gathered from the instruments were used in the information presentation and types of activities for the module (research question 3). Crucially, the information presentation and selections of activities for TEMI were prioritised on the most preferred or dominant learning styles gathered from the learners.

3. Results

3.1 The Learners' Learning Styles

Prior to the development stage, a survey on 63 UMP learners (regardless of race and gender) was conducted to identify the learners' learning style. The learners' learning style was assessed using Honey and Mumford Learning Styles inventory. The findings then, were analysed using descriptive analysis of percentage as depicted in Figure 2.

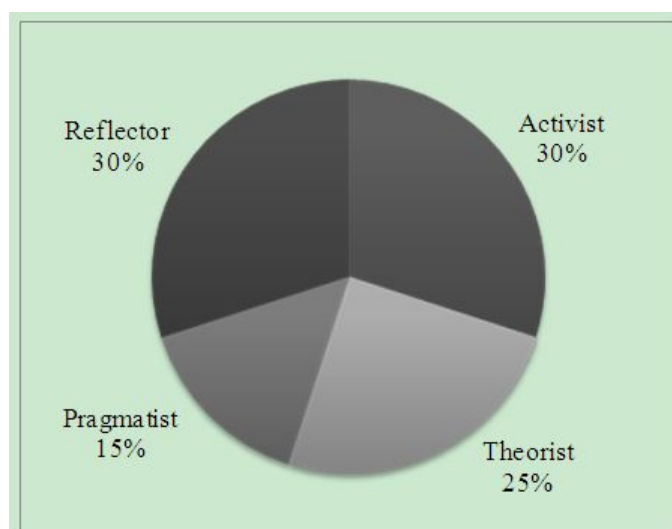


Figure 2. The learners' learning styles based on Honey and Mumford (1992)

As illustrated in Figure 2, the Activist and Reflector were the dominants learning styles among the respondents. It was therefore decided that the designed of TEMI prototype should be prioritised on the two. This meant more activities and materials that reflected the preferences of the Activist and Reflector groups as compared to other two, especially the Pragmatist. The results from the learning styles were also used and discussed in the information presentation and types of activities for TEMI.

3.2 The Design of User Interface (UI)

The first part of the development of TEMI user interface (UI) was the front page (Figure 3). The design of TEMI UI was underpinned and operationalised based on the three learning theories discussed in this study.



Figure 3. The front page or the user interface of TEMI

Accordingly, the principles of the three learning theories were operationalised in the courseware through

1) Behaviourist

The persistent need to click and control learning sessions using mouse/keyboard and even touch screen (for tablets) offered a total control (learners' autonomy) in learning. Learners were encouraged to learn and monitored based on feedbacks (support and approval) received for each action or decision made.

2) Cognitivism

Learners' mental processes i.e. to read-understand-reflect were actively engaged with activities that matched their interest. It kept them focus, thus, allowed more retention of knowledge. This gave a positive impact on learners' action which can trigger confidence building, after a period of self-regulation. The learners' progress or achievement in each attempt served as a mean to measure the attainment of learning outcomes (LO) set for the course which were based on Bloom's Taxonomy.

3) Constructivist

Though the only interaction available was the content of the courseware, the learners' constructions of new knowledge were gauged based on their schemata, related to their experiences and relevant to their field of studies (engineering context). The prototype of the courseware was also enhanced with interactive elements, something that a book cannot offer.

All the elements of all the learning styles i.e. Theorist, Pragmatist, Activist and Reflector based on Honey and Mumford (1992) were embedded in the development of TEMI prototype.

3.3 The Information Presentation

The information presented in TEMI were based on the learners' learning styles especially the dominant ones (the Reflector and Activist). Figure 4 presents an example of this adaptation.

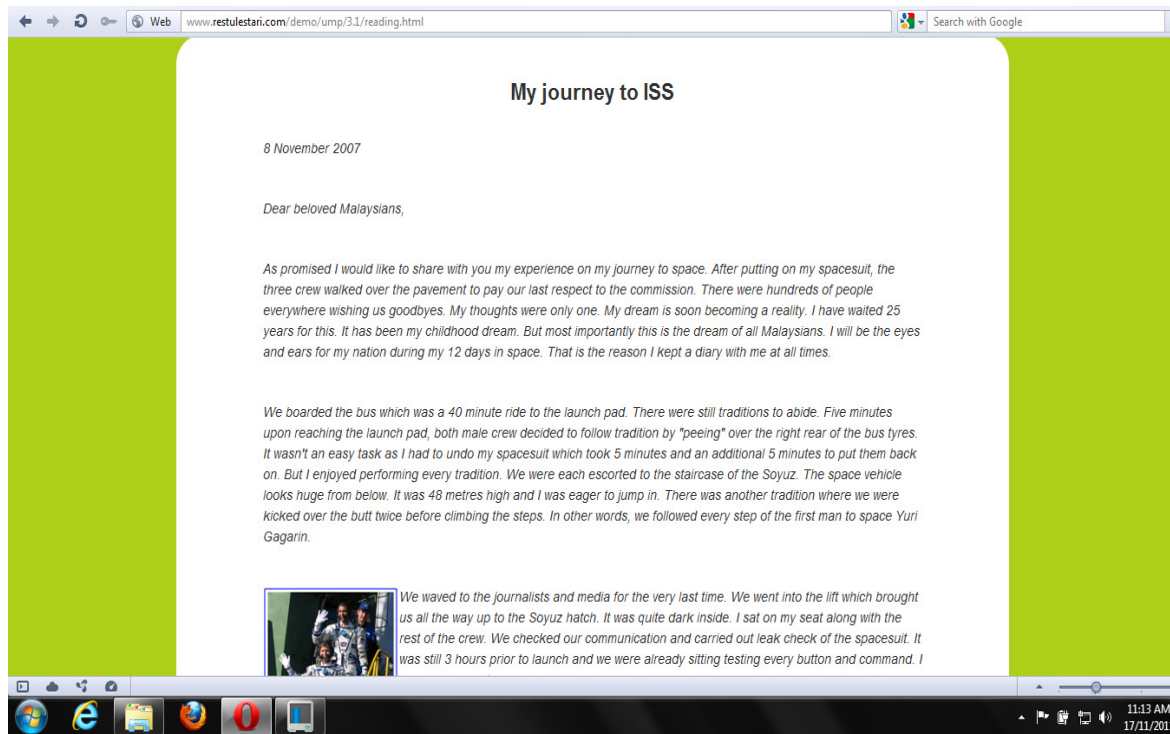


Figure 4. Learning activity (stories and discussion) that depicts theorist and pragmatist learning style in TEMI

The Learning Activities

In TEMI, the learning activities were designed to accustom with the learners learning styles. For instance, the brainstorming activities and background information reflected the Activist and Theorist learning preferences (Figure 5).

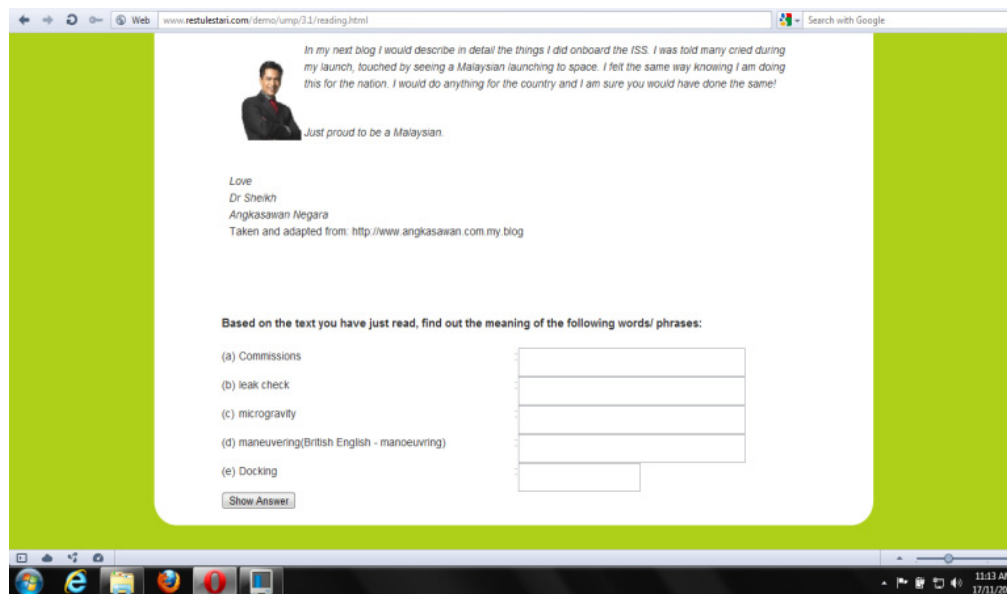


Figure 5. An example of TEMI learning activities that matched activist and theorist learners

As well, learning activities that required models, theories applications and knowledge application signified preferences of Theorist and Pragmatist type of learners (Figure 6).

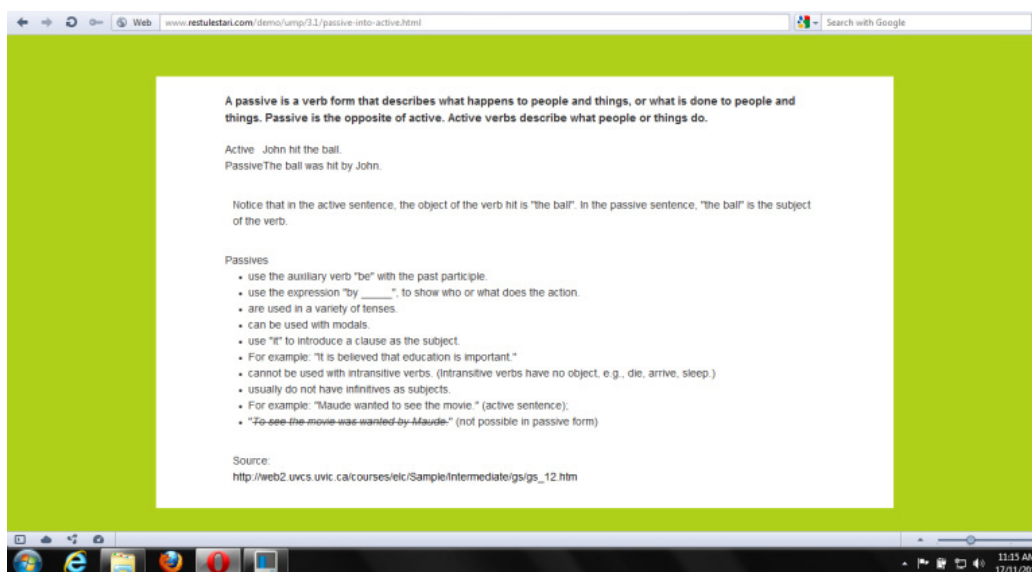


Figure 6. Examples of learning activities that matched with theorist and pragmatist learners

Leaving none behind, problem solving and applying theories skills types of learning activities were also devised to cater to Activist, Theorist and Pragmatist types of students learning preferences (Figure 7).

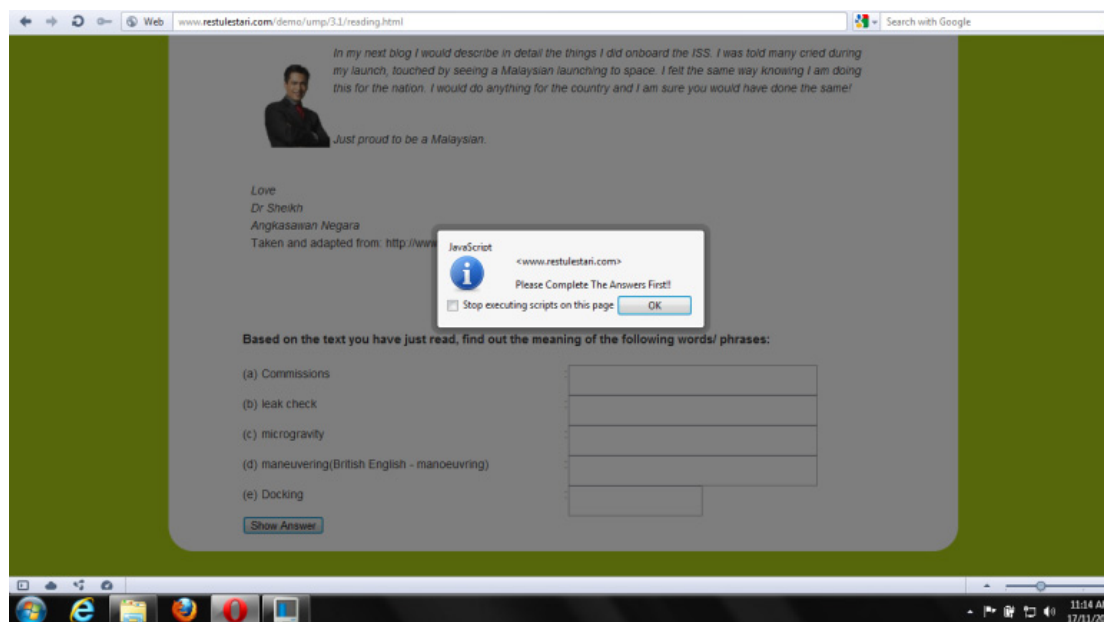


Figure 7. An example of interactivity element for the activist, theorist and pragmatist

4. Discussions

TEMI was developed on the basis to tap on the learners' interest by accommodating to their learning styles. The aim was on optimising the SCL as well as raising the SLT as mentioned before. The development of TEMI focused on the key component of ADDIE model and the principles behind the three learning theories. It was underpinned by behaviorism, cognitivism and the most significantly the constructivism learning theories in suiting with the learners' learning styles. The concerns throughout the stages in developing TEMI were on

- 1) The design of the User Interface that should be 'connected' with the learners' preferences in gauging learning to take place.
- 2) The development of TEMI prioritised the fundamental preference of the users' (learners') learning styles in designing the workflow for learning activities.

3) The fundamentals of TEMI must promote learners' autonomy and social relatedness of the learning object.

The significance of the study is to replace the traditional method of using module or book and where the learning activities rely heavily on the presence of teachers. The shift to using the courseware that strives to meet the learners' learning styles is an optimisation for a more meaningful language learning among the undergraduates. To add, the courseware is the researchers proactive act towards preserving the nature: 'Paperless and paper less.' The researchers also intend to find out the effects of TEMI as a tool to bolster learners' positive perception toward language and communication courses in optimising the learning of the knowledge of their major fields i.e. engineering (Lengsfeld, Edelstein, Black, Hightower, Root, Stevens & Whitt, 2004).

Additionally, the learners are afforded with opportunities to enhance their communication and technological competencies (Davis, Beyerlein & Davis, 2006). TEMI offers a more individualistic approach of learning the language of what seems to be impossible to propound when compares to the traditional method especially with larger pool and diverse backgrounds learners in a class session. The design and development of this module which utilises computers will be a major pulling factor to the learners as they are interacting with the content in a platform that is accommodating to their learning styles.

As an end product, TEMI is likely to be a solution to the relentless rise of academic workload and the heightened demands on educators' time caused by the reform in HEIs (Evans & Abbot, 1998) among English educators that have inter alia inhibited effective teaching of the language to learners. It is however, vital to caution that TEMI is simply not an act in passing of the baton to learners; it is about shifting the responsibility of language learning to learners with supports of more flexible time and individual approach and pace, so as to alternate and sustain what is primarily taught in a classroom setting.

5. Conclusion

TEMI is the researchers' eloquent effort in integrating technology in an English language course offered at the university. It attempts to address the eclectic backgrounds of the learners at the university whose interests are in learning engineering fields. Tapping on the learners' interest through their preference styles of learning, TEMI offers an interactive way of engaging the learners in learning the language so that the learners learning time (SLT) are recorded, optimised and justified. As well, it highly supports the SCL approach which permits learners to be actively engaged in learning the language; breaking away from the authority of lecturer-dependent and text-book reliance.

However, TEMI development is not without effort. It compels technological competence among the English educators in coming out with the interactive multimedia module that matches with the learners' learning styles, taking into account the learners' diverse backgrounds and proficiency. The interactivity of the design also needs to consider the learners' discipline content so that it optimises the learners' opportunity to enhance their language proficiency that will be useful for academic purposes as well as future engineering professionalism. Hence, investigations on ESL educators' teaching in other disciplinary fields technological competence are highly recommended so that it elicits substantial needs and sources for the language educators ICT integration professional development participations.

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