Contemporary Engineering Sciences, Vol. 8, 2015, no. 1, 39 - 47
HIKARI Ltd, www.m-hikari.com
http://dx.doi.org/10.12988/ces.2015.412254

Online Intellectual Transformation System

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Abstract

This study investigates the potential of an online intellectual transformation system acronym as *i*-InTranS, in enhancing intellectual transformation. Using Moodle as the learning management system, the system was proposed to deliver a content that was customized to embrace hypothetical-deductive learning cycle (HDLC) as the inquiry model. A total of 35 students in the district of Johor Bahru, Malaysia were selected through cluster random sampling technique to use the proposed system. Based on mean scores of Intellectual Level Tests, it can be concluded that there are differences between users' intellectual level before using the proposed system, *i*-InTranS and after using it.

Keywords: hypothetical-deductive learning cycle, constructivism, inquiry learning

1 Introduction

To be a competent learner, one should achieve a suitable intellectual level. According to Lawson [1], the intellectual levels for teenagers include Empirical-inductive (EI) level and Hypothetical-deductive (HD) level. However, some experts favor to propose the existence of three intellectual levels when dealing with subjects at the age of 14 years old to 18 years old by including Transitional Level as one of the three upper most intellectual levels.

It was found that intellectual level among secondary school students was lower that what it should be, in order to be a competent learner [2]. Researches however, showed that it is actually possible to nourish intellectual level to attain higher level. It was discovered that intellectual transformation could be catalyzed through actively interacting and learning in inquiry environment as what scientists and researchers encounter [2] [3]. At the same time, inquiry is the optimum way of generating scientific knowledge at any levels [4].

The current study attempts to develop a system which is capable of catalyzing user's intellectual transformation. The system was made available online and was stored inside the Faculty of Education, Universiti Teknologi Malaysia server. Apart from customizing to suit with the *i*-InTranS application, the computers used during the experiment session were installed with the latest Mozilla Firefox and the latest version of Flash Player. In the next section, the design and development of *i*-InTranS will be described.

2 The Design and Development of the Proposed System

To catalyze intellectual transformation, the hypothetical-deductive learning cycle (HDLC) engineered by Lawson was used [1]. The HDLC involved a holistic learning process that makes the presentation of the content and the step-by-step inquiry elements to be easily executed during learning session.

The design and development of *i*-InTranS was supported by constructivism theory and inquiry learning strategy. Constructivism conveys an idea that scholarship construction occurs when individual actively interacts with the environment [5] [6].

Figure 1 illustrates the framework used in designing and developing *i*-InTranS. The framework consolidates the ponderous components of constructivism and HDLC into the proposed system. The development process of *i*-InTranS was based on ADDIE as the Instructional Design (ID) Model. ADDIE model is an example of an instructional design model where changes can be made according to trends and developments. In other words, it is suitable in a rapidly changing learning environment [7].

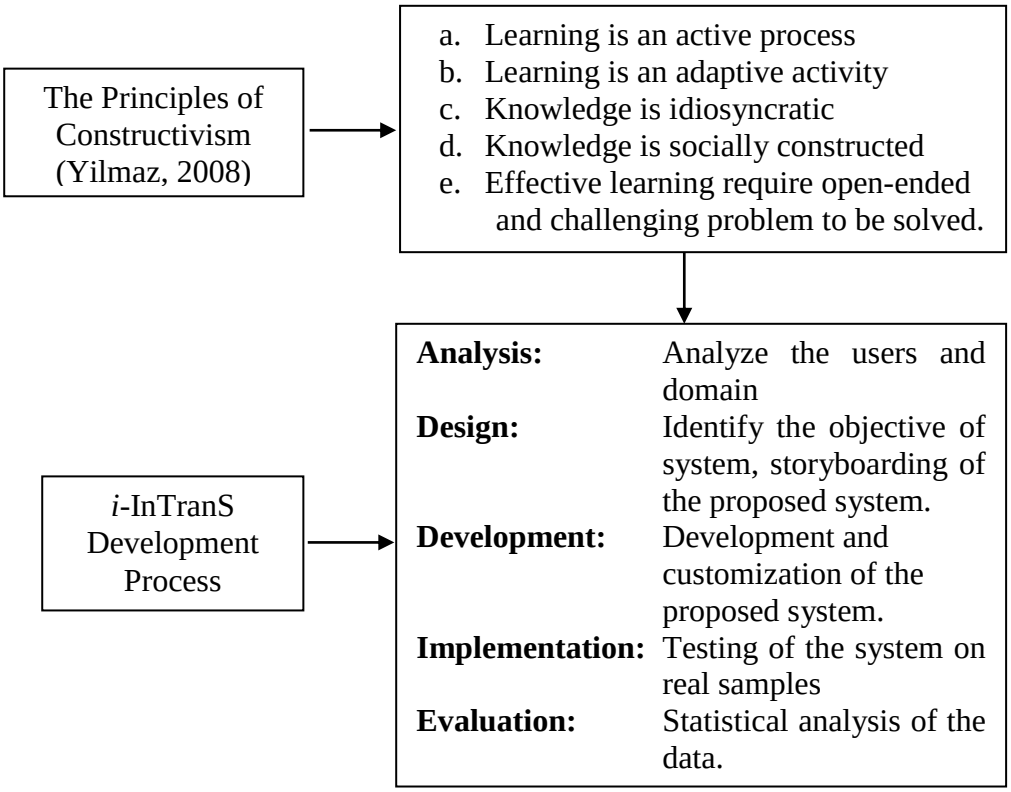


Figure 1: Framework of Design and Development for *i*-InTranS

During the analysis phase, the content area and users were analyzed. For the purpose of the current study, Chemistry domain and Electrochemistry subject were selected as the content of *i*-InTranS. The key characteristics of the users were analyzed in order to understand their basic needs. The process of designing and developing of *i*-InTranS began with information on the configuration of *i*-InTranS. It then went further to the theoretical application of the constructivism theory and HDLC in *i*-InTranS. The system began with the Introduction Page. The Introduction Page is a webpage that gives some insights to the users regarding the purposes and basic structure of the system.

Upon login, users were presented with the Main Interface page. At the Main Interface page, users were provided with forum and chatting box for social interaction at the beginning of using *i*-InTranS and to make them familiar with these utilities. Figure 2 shows the main interface of the system. At the upper left corner of the interface (A), there is a menu of setting for users to change the layout of the system, based on their preferences. It also includes the menu for calendar, the report on recent activities in the system and incoming events. At the right side of the interface (B), the user's profile is displayed. All activities in the system are recorded in the area marked by C.

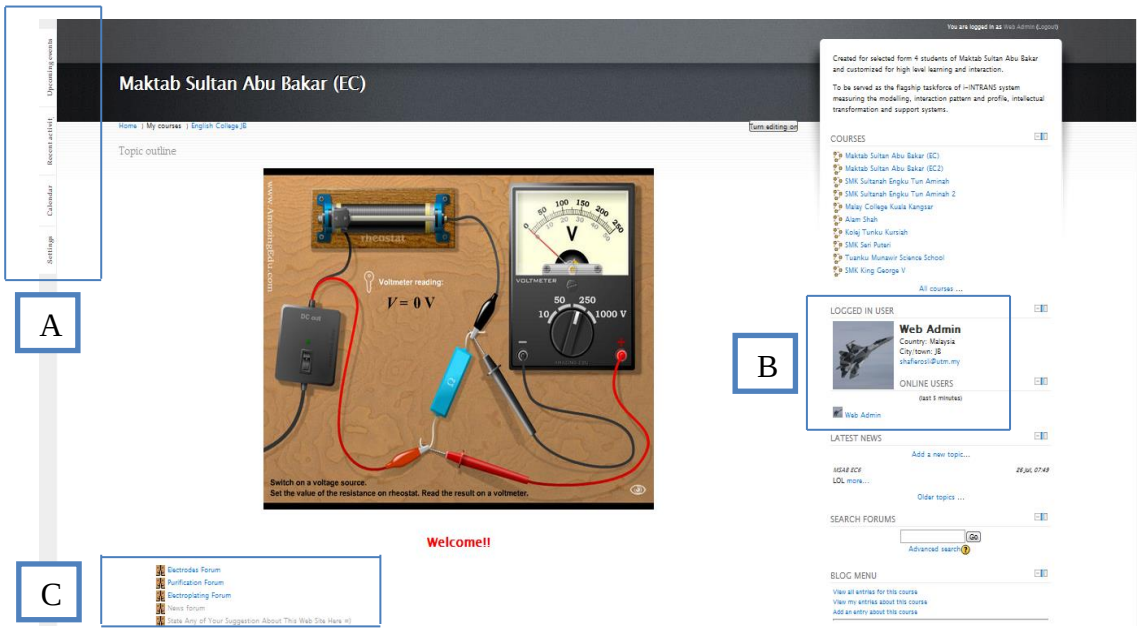


Figure 2: Main Interface Page

To advocate reflections after using the system, a forum utility was added into the system. Both the researcher and the users have the authority to initiate new topics. The forum utility in *i*-InTranS is illustrated in Figure 3.

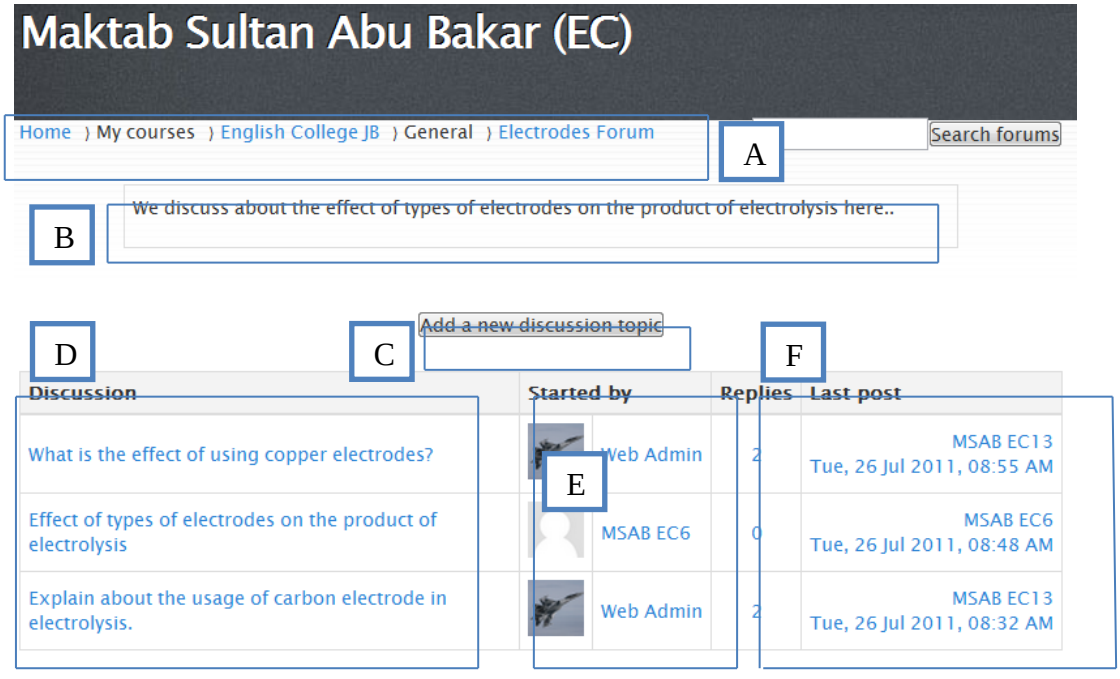


Figure 3: The Forum Page

The information for each labeled parts in the forum page in Figure 3 are as follows:

A: Information regarding the path of the forum.
B: Brief information on the purpose and objective of the forum.
C: Option to add new topic for the forum.
D: List of topics that have been discussed.
E: Name of user or instructor who starts the discussion.
F: Last user or instructor who responds to the forum and the number of replies.

Users were also equipped with chatting utility. The purpose was to enable the users to communicate among themselves or with the researcher privately. Users can ask, participate, share and get the answer for their questions. Anyone can start the chat as it was made available to all and can be easily accessed.

A lesson began with users being given a question and being guided with what that they need to include in order to answer the question. Figure 4 illustrates an example of the lesson interface.

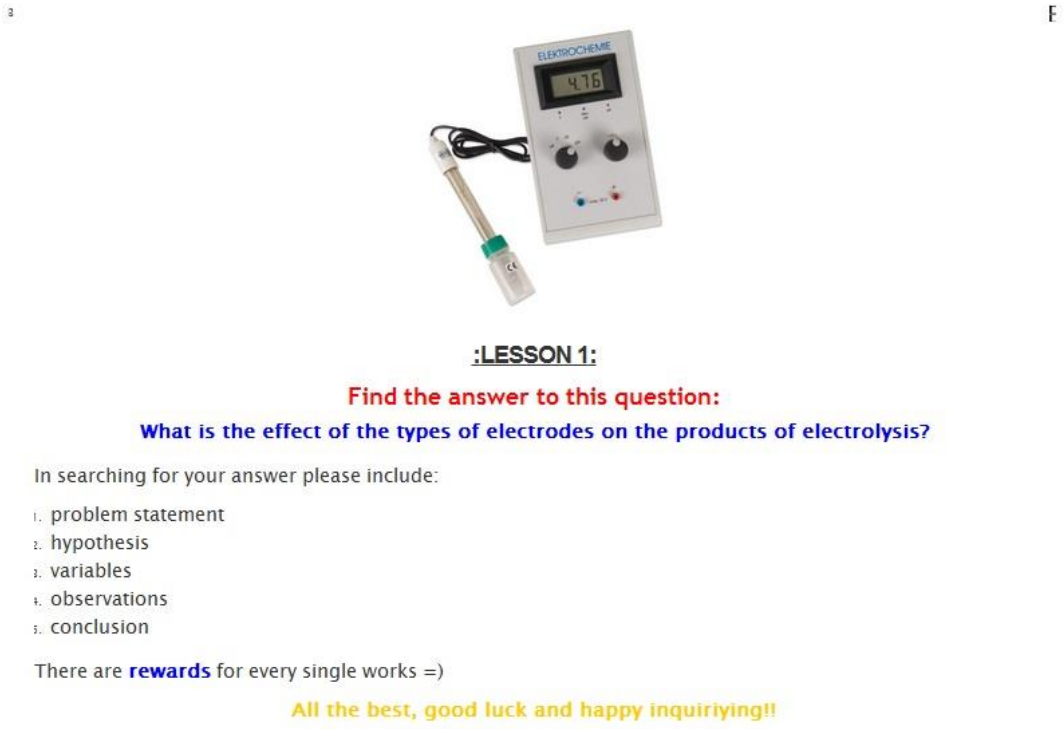


Figure 4: Lesson interface

At the Inquiry Activities Interface, users were introduced with the main element of inquiry-based learning activities as detailed in HDLC. The imperative components of inquiry-based learning activities are identification of the aims of

experiment, statements of problem that are being investigated, identification and classification of variables and ability to draw a precise conclusion. The system was equipped with sets of simulations to create an inquiry learning environment.

The proposed system *i*-InTranS was designed and developed based on the constructivism theory. In *i*-InTranS, active learning can be found through the process of answering the causal question by users. The learning is an adaptive activity principle in *i*-InTranS can be traced from the genesis process of hypothesis generation. In the process of hypothesis generation, users have to propose their hypothesis based on their own ideas. Then, users have to test their hypothesis as being true or false or maybe some forms of modification is needed. The principle that knowledge is socially constructed can be spotted in *i*-InTranS from the flexibility granted to users to openly interact in the system. Inquiry-based learning must involve an open-ended problem to primarily developing learners' thinking is well digested and widely accepted among constructivist [8][9][10]. Therefore, in i-InTranS, the researcher had provided the users with causal questions that are challenging and have open-ended rather than predetermined outcomes. The causal questions served as the main driving force for users to complete their investigation.

i-InTranS was engineered to be encompassed by HDLC. In HDLC, there are six analytical elements that are profiled into stages. The six analytical elements of HDLC are shown in Figure 5.

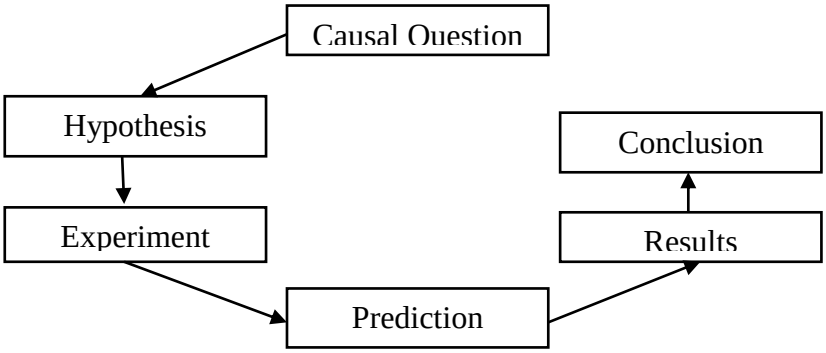


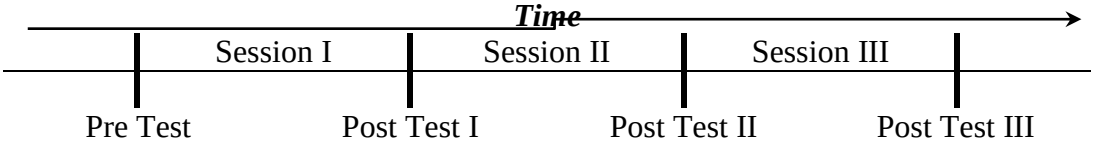
Figure 5: The Hypothetical-Deductive Learning Cycle (HDLC)

3 Implementation and Results

In order to gain knowledge into the effect of using *i*-InTranS during a long term spectrum, the researcher had adopted the longitudinal research design. The implementation phase was for a period of three consecutive weeks. Three weeks period is acknowledged as tolerable to identify the pattern of cognitive development and three weeks period is a considerable period for cognitive maturation to transpire [11][12].

Thirty-five students taking Chemistry from Maktab Sultan Abu Bakar in Johor Bahru, sampled via cluster random sampling technique were selected. They were exposed to three separate sessions of interventions with each session conducted for about 90 minutes. In total, the students used *i*-InTranS for about 270 minutes during the experiment. The student first sat for a pre-test then followed by first session of learning via *i*-InTranS. Post to Session I, the students sat for Post-Test I. The students then took Session II followed by Post-Test II. After the students had taken Session III, they sat for the last post-test, Post Test III. The structure for time series design adopted for the current research is in Table 1.

Table 1: The Research Design (The Time Series Design)



The summary of intellectual level test scores are listed in Table 2.

Table 2: Summary of Intellectual Level Tests Scores

Number of Samples (*n*)	Pre Test		Post Test I		Post Test II		Post Test III	
	mean	SD	mean	SD	mean	SD	mean	SD
35	6.76	2.33	5.86	2.61	7.01	3.06	7.51	1.96

The means and standard deviations (SD) for all the intellectual level tests scores are summarized in Table 2. The mean and standard deviation for the pre-test are 6.76 and 2.33 respectively. After a week of Session I, the first post test was conducted. The results of the post test I showed a decrease in the overall intellectual level of the samples as the mean of scores was decreased by 0.9 from 6.76 to 5.86.

As the session came to its second week, a positive effect on intellectual level was recorded. Based on the second post-test result, the value of the mean increased from 5.86 to 7.01, implying an increment of 1.15. After three consecutive weeks of sessions, the last post-test was administrated to the students. The last post-test had recorded the highest mean value of 7.51. The mean has increased by 0.5 when compared to the previous mean score. At the same time, the standard deviation value has decreased from 3.06 to 1.96.

4 Concluding Remarks

Engaging *i*-InTranS has the ability to empower students to achieve higher intellectual level. Thus, learning via *i*-InTranS is highly beneficial for students as a mean of optimizing their learning ability and capacity. Additionally, *i*-InTranS provide the students with an interactive and attractive technology enhanced learning environment as alternative to the traditional methods and conventional classroom.

The findings of the current research also enhance the need on active consolidation of multimedia courseware as a tool in classroom. It not only has the ability to ease teacher's task, but it also has a positive impact on students' epistemological development.

Acknowledgements. This work was supported by ERGS Grant Vot No: R.J130000.7816.4L088. The authors would like to thank Universiti Teknologi Malaysia (UTM) for providing the funds and facilities.

References

[1] A.E Lawson, *Science Teaching and Development of Thinking*, Wadsworth Publishing Company, California, 2002.

[2] Ibrahim Kamaruddin, Zainudin Abu Bakar, Johari Surif and Winnie Sim Siew Li, *Relationship Between Cognitive Styles, Level of Cognitive Thinking and Chemistry Achievement Among Form Four Science Students*. Unpublished note. Universiti Teknologi Malaysia, 2004.

[3] P. C. Wankat and F. S. Oreovicz, *Teaching Engineering*. Perdue University, United States, 1993.

[4] National Science Learning Centre, *Taking Inquiry-Based Science Education into Secondary Education*. IAP – International Conference: Taking Inquiry – Based Science Education (IBSE) into Secondary Education. University of York, 2010.

[5] C. Tsai, The Interpretation Construction Design Model for Teaching Science and Its Applications to Internet-Based Instruction in Taiwan, *International Journal of Educational Development*, **21** (5), 2001, 401-415. http://dx.doi.org/10.1016/s0738-0593(00)00038-9

[6] C. Tsai, The Preference toward Constructivist Internet-Based Learning Environment among University Students in Taiwan, *Computers in Human Behavior*, **24** (1), 2008, 16 – 31. http://dx.doi.org/10.1016/j.chb.2006.12.002

[7] D. Yuan, J.Zhong, *An Instructional Design of Open Source Networking Lab and Curriculum*. Proceeding of the 10th Conference on SIG – Information Technology Education, Fairfax, Virginia, USA, 2009, 37-42.
http://dx.doi.org/10.1145/1631728.1631742

[8] K. Yilmaz, Constructivism: Its Theoretical Underpinnings, Variations, and Implications for Classroom Instruction, *Educational Horizons*, **86** (3), 2008, 161 – 172.

[9] B. Green, B. (2010). Rethinking the Representation Problem in Curriculum Inquiry. *J. Curriculum Studies*. **42** (4), 2010, 451 – 469.
http://dx.doi.org/10.1080/00220270903494998

[10] J. R. Staver, Constructivism: Sound Theory for Explicating the Practice of Science and Science Teaching. *Journal of Research in Science Teaching*, **35** (5), 1998, 501 – 520.
http://dx.doi.org/10.1002/(sici)1098-2736(199805)35:5<501::aid-tea3>3.0.co;2-t

[11] K. P. Gibson and A. C. Petersen, (Eds.), *Brain Maturation and Cognitive Development: Comparative and Cross-Cultural Perspectives*, Social Science Research Council, New Jersey, 2011.

[12] J. Stiles, J. S. Reilly and S. C. Levine, Neural Plasticity and Cognitive Development. Oxford University Press Inc., New York, 2001.

Received: December 27, 2014; Published: January 27, 2015