Title	
Author(s)	Mohamed, Mohamed Elsayed Ahmed
Citation	
Issue Date	2017-03
Type	Thesis or Dissertation
Text version	ETD
URL	http://hdl.handle.net/10119/14240
Rights	
Description	Supervisor: , ,

氏　　　　　　　名	Mohamed, Mohamed Elsayed Ahmed	
学 位 の 種 類	博士(情報科学)	
学 位 記 番 号	博情第 354 号	
学 位 授 与 年 月 日	平成 29 年 3 月 24 日	
論　文　題　目	A Virtual Learning Platform for Developing Skills of Designing and Producing Online Virtual Laboratories	
論 文 審 査 委 員	主査　長谷川 忍　　北陸先端科学技術大学院大学	准教授
	飯田 弘之　　　　　　同	教授
	池田 心　　　　　　　同	准教授
	益川 弘如　　　　静岡大学	准教授
	國宗 永佳　　　　信州大学	助教

論文の内容の要旨

The expansion of using new virtual learning applications in educational institutions requires enhancing educators' skills of design and production in such applications. Those skills must be acquired by educational technology students for the future of education because they often lack the above skills in their curriculum. The main purpose of this research is to investigate the effectiveness of virtual learning platform (VLP) in order to cultivate the students' skills in designing and producing online virtual laboratory (OVL) with a standard way. In the context of this research, the OVL is an online practical environment for a specific topic, which makes learners active such as learning by experience and by trial-and-error. On the other hand, the VLP means a web-based learning system including several functions/tools for presenting and managing the OVL.

In order to teach the educational technology students how to design and produce OVL (DPOVL), a new instructional design (ID) model is proposed as standard components for teaching guidelines of DPOVL. Based on the literature review, the model is comprised of the following six phases; OVL pre-design, DPOVL criteria, OVL design, OVL production, OVL experiment-implementation, and OVL evaluation. Moreover, we present a list of practical skills in DPOVL to clarify which kinds of the skills to be cultivated in this research.

We also propose an educational software development process, especially for designing and producing the VLP by integrating some features from software engineering (SE) into the traditional ID framework. The proposed process contains the next five phases; analysis, construction, deployment, implementation, and evaluation, to develop a high-quality product with an iterative process. Based on these model and process, a new VLP software is developed with several

innovative tools and special course contents to cultivate the target skills. The developed VLP consists of the following tool groups; a) Learning tools: They support online learning with interactive contents and web activities.   b) Management tools: They assist the administration of online learning environment such as user management and content management. c) Communication tools: They facilitate collaboration between the students and the instructors with real-time and/or on-demand style. d) Innovative tools for OVL: They focus on the students' skill cultivation of DPOVL with a template method. e) Evaluation tools: They simplify assessment of the students' performance with various methods like quizzes, questionnaires, and rubric scales. f) Help tool: It guides the students to use the VLP tools through a brief explanation.

Eventually, the empirical experiment was conducted with a quasi-experimental research design in order to evaluate the effectiveness of the proposed VLP in cultivating the skills of DPOVL. Thirty students, who were the fourth grade of undergraduate students majoring in educational technology, Faculty of Specific Education, South Valley University, Egypt, participated in the experiment.   All the students as the participants were assigned to one group as a pre- and post-test design. The data were collected by using online instruments; achievement test, performance observation card, product evaluation card, and usability questionnaire. The results indicated that the VLP had a positive impact on cultivating the following knowledge and skills with significant effectiveness; a) Attaining the knowledge regarding theoretical and practical aspects of DPOVL, b) Acquiring the skills related to a practical aspect of DPOVL, c) Producing the OVL products in the various educational domains.   It was also suitable for the educational technology students to learn with the proposed VLP in a comfortable way. From these results, the VLP could provide a significant learning environment to cultivate the specific skills in DPOVL.

In conclusion, there are five main contributions of this research in the educational technology field; firstly, it proposed a new ID framework to teach the educational technology students DPOVL with the fixed format and suitable components. Secondly, it defined the list of 34 practical skills for DPOVL. Thirdly, it adopted the iteration process in designing and producing the VLP to keep the educational software high quality. Fourthly, it provided the novel VLP with the template method to learn the practical skills effectively in DPOVL. Finally, the results of the experiment showed that there was the significant difference with the large effect size between the pre-test mean scores and the post-test mean scores of the experiment group with respect to developing knowledge and skills of DPOVL. In addition, the results indicated that the proposed VLP had a positive impact in producing the OVL products in several educational domains with high mastery level. In the end, the students strongly agreed on the usability of the VLP software.

論文審査の結果の要旨

　本論文は，教育工学を専門とする大学生を対象として，オンライン上で様々な現象をシミュレーションする学習環境である Online Virtual Laboratory の設計・開発に関するスキルを向上させるためのインストラクショナルデザインモデルを提案するとともに，開発したプラットフォームの有効性について実践的な利用を通じて評価・考察したものである.

　　Online Virtual Laboratory の有効性はこれまでも自然科学を中心とする様々なドメイン・学年を対象として多くの研究で認められている. 一方で，それらを実際の教育に適用するために教師やインストラクショナルデザイナーの人材育成を検討した研究はほとんどなされていない. 本論文はこのように従来あまり焦点化されなかった課題を解決するために，様々な分野の先行研究を参照して，教育工学を専門とする大学生に適用可能なインストラクショナルデザインデザインモデルを提案するとともに，Online Virtual Laboratory の設計・開発に必要なスキルを定義した. さらに，こうした認知的なスキル学習を支援することにフォーカスした仮想学習環境プラットフォームを開発するための方法論として，従来のインストラクショナルデザイン手法にソフトウェア工学の手法を組み合わせた新たなモデルを提案するとともに，提案モデルの妥当性を検証するために，仮想学習環境プラットフォームおよび学習のためのコンテンツを開発した. 最終的に，提案したプラットフォームの有効性を評価するために，30 名の教育工学を専門とする大学生によるプレ・ポストテストによる評価実験を実施し，学習後の理解度，設計・開発スキルが向上したことおよび，学習者が提案プラットフォームを利用することで一定レベルの Online Virtual Laboratory を生成できることを示した. 今後，エジプトにおいて実運用を継続することで比較可能なデータ収集およびシステム改善のサイクルが期待される有用性の高い研究であるとも言える.

　以上，本論文は，Online Virtual Laboratory の設計・開発スキルの向上を目的とした仮想学習プラットフォームを開発することで，これまで標準的な教育方法が確立していなかった認知的なスキルに対して，実際に開発を行いながらトレーニングできる環境を提供するものであり，新たなインストラクショナルデザインモデルの提案と認知スキル学習支援の実質化の観点から学術的に貢献するところが大きい. よって博士（情報科学）の学位論文として十分価値あるものと認めた.