

Investigation on Adaptive Context-Aware M-Learning System for Teaching and Learning Basic Hindi Language

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Abstract

Background: Hindi being India's official language, it is critical to know how to improve teaching methods and strategies to effectively help non-native speakers to overcome the language barrier. **Methods:** The major purpose of the article is to investigate adaptive content m-learning system for learning and teaching basic Hindi. It is expected from the literature that the interactive teaching characteristics are activities of student-centered for communication during real-life sociable situations. **Findings:** Hopefully, this basic Hindi language learning system will be able to help the students learn the unknown language by relying on the system's interaction to augment their language learning. It gives teachers a practical knowledge to use the system and receive extra information. **Applications:** It helps to assess learners from different viewpoints and provides an in-depth understanding of students in different learning styles.

Keywords: Adaptive Content, Context Based, Hindi Language, M-Learning, Personalized Learning

1. Introduction

Mobile devices could engage learners in situated and experimental learning without device, time and place restrictions; allow learners to continue activities for learning, support on-demand access to resources of education with respect to commitments of students and permit for new knowledge or skills to be applied immediately and so on¹. System for adaptive learning aims to give a personalized resource for learning for students, particularly user-preferred interfaces and learning content to process their learning². Two approaches for adaptation could be adopted in emerged web-based systems for adaptive learning such as adaptive presentation that provides personalized content with specific reference to individual students and support for adaptive navigation that guides individuals for determining the content for learning by recommending personalized paths for learning³.

Further the significance of giving personalized

interfaces for user for meeting the learning attitudes and preferences of students⁴. Supporting the student learning levels by mobile phones or devices could give a significant dedication and there is a main ability in such technology in case of education and adopting such field would be essential for the future⁵. In addition to these, it was noted that outcomes of learning was positive when adopting such methods. Personalized services for learning play a main role in the online learning as there is unfixed path for learning is suitable for all kind of learners⁶. At the same time, conventional systems for learning neglect such service need and deliver the same content for learning to all learners. Such approach was ineffective for learners with unique abilities and backgrounds. For designing an adaptive content for learning, then it is necessary to allow and deliver the learning context based on the specific learners' requirements⁷.

Even though the student's knowledge level and learning content's complexity level are good factors to adapt layouts

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for presentation and choosing suitable learning content for individual learners in significance of considering learning habits and personal preferences⁷. Further, it was stated that the learning styles in the personal characteristics demonstrate the way individuals understand and information of process were recognized as significant factor regarding learning materials presentation⁸.

2. Overview of Context-Aware Adaptive and Mobile Learning Systems

In one of the research works on personalized system for adaptive content for context-aware mobile learning revealed ubiquitous and mobile devices for computing are changing its way that learners learn. Majority of the contents for learning, developed particularly for platforms used for desktop are unsuitable for handheld devices⁹. At the same time, some materials are not relevant to the contextual environment and learner's preference would affect the efficiency of learning and maximize the costs of communication. For providing adaptive contents on the basis of learner's experience and capabilities proposed functional architecture. For resolving the diversity of mobile device and contents for learning, this research developed architecture of personalized and adaptive system with specific reference to ubiquitous environment for learning. This research developed some algorithms for creating the intelligent and adaptive contexts for students. In addition to these, stated that contents for learning generated are adaptive to the preference of learner as well as adaptive to the contextual surroundings. New items were also suggested on the basis of Top-K technologies and clustering technology. Apart from these, it was noted that adaptive contents were developed for learners on the basis of experience of learners and capabilities for device.

From the findings of the analysis, it was clear that, mobile learning system based on context-aware could maximize the interest and efficiency of learning as well as resolves the question of new-item at the time of adaptation. One of the previous study explained that how to model the learner and all possible contexts in an extensible way that can be used for personalisation in mobile learning¹⁰.

The main aim of the improved model of learner is to enhance the profile of learner because it is the major inputs for the layer of reasoning. The enriched model of learner comprises of 4 major components, namely the status

of situation, the learner status representation, status of educational activity and the status of shared and knowledge properties. The presented system offers personalisation by acquiring a hybrid approach, integrating two techniques of machine learning (neural network and fuzzy logic) to offer a developed experience for m-learners. Presently this system's implementation is in progress and the system's effectiveness will be estimated both qualitatively and quantitatively.

Recent research introduced the Adaptive Neuro Fuzzy Inference System (ANFIS) as an engine of reasoning to provide the content of learning for applications of m-learning¹¹. This research was conducted to describe the essential effectiveness of adaptive neuro fuzzy inference system with hybrid learning, for conversion of the format of learning content for users of m-learning. The Adaptive Neuro Fuzzy Inference System performance was estimated using measurements of standard error which showed the optimal setting essential for good predict-ability. The numbers of fuzzy norms acquired from the experts of human were inadequate; therefore, this research acquired a hybrid process that integrated the Fuzzy Inference System with Neural Network in deciding a complete system of fuzzy rule. The adaptive neuro fuzzy inference system approach has solved the incompleteness issue successfully in the fuzzy rule base made by human experts. By training the Neural Network to use the fuzzy rule base of human expert's to varied data of training, the Neural Network is anticipated to identify other decisions that were not detected previously.

In a recent study presented an approach based on ontology to evolve adaptive electronic learning system based on the semantic content design, domain and learner models to tailor the process of teaching for needs of individual learner¹². Ontology is used to indicate the content, domain and learner models in the approach. The model of learner explains characteristics of learner needed to provide the tailored content. The model of domain comprises of certain properties and classes to refer semantic relationships and domain topics between them. The model of content explains the courses structure and their components. The personalized content comprises numerous varied instructional objects which is tailored to a specific learner based on the facts in the model of learner. The learner response to certain regular tests during the process of learning is examined by the theory of item response to estimate learner's ability. The system identifies alterations in learner's knowledge level as they advance. Accordingly, the model of learner is

updated based on the progress of learner and the passage from one step of the process of learning to next step is decided based on the updated profile of learner.

Engineer evolved a multiple perspectives adaptive learning system based on students' cognitive styles and learning styles¹³. The experimental outcomes revealed that the proposed system could develop students learning accomplishments. Moreover, it was predicted that the mental load of students' was reduced essentially and their trust of learning gains was developed. As mental load defines to communication between the tasks of learning, content of learning, and the content characteristics (e.g., difficulty level), it is highly associated to content's difficulty level presented to students and prior knowledge of students' for understanding the content¹⁴. In this paper, the content of learning offered to both student groups was similar although the style of presentation might be adapted based on their styles of learning and the interface was adapted based on their cognitive styles. On the other hand, mental effort is associated to strategies of learning used in the activities of learning.

Therefore, based on the theory of cognitive load, it was anticipated that the 2 groups had varied mental efforts and common mental loads. However, the experimental outcome was parallel to the anticipation which challenges certain major assumptions of the theory of cognitive load with regard to the styles of learning and is worth learning further. In control belief terms, which defines to beliefs of learner of being capable to perceive the content of learning and have better achievement of learning, the generated materials of learning were used to meet characters of individual students' of processing the data i.e., the learning content's presentation style was much applicable to information processing styles of students. Therefore, it is logical that in the experimental group students revealed greater control beliefs than those in control group. From the results of experiment, it can be viewed that the proposed process is promising. The developed system can be used to other applications by putting back the components of learning with the new ones. To evolve new applications of adaptive learning, researchers or teachers require only to change the materials of new learning into individual learning components types and store them in learning system database.

Researcher argued about the adaptive LMS (Learning Management System) using semantic web techniques¹⁵. The vision of Web 3.0 is personalization which is a next generation web. The design of instruction is an

area which is still not given importance as far as the semantic web is concerned. Accomplishing this target in services of electronic learning is a challenging one. In this study the author has tried to offer theoretical perspectives of integrating 2 or 3 areas of their interest and bridge the space between these areas. The adaptive learning management system's conceptual framework integrates ontology operations, knowledge management for reasoning, detection of learning style, and electronic learning services dynamic composition using planning algorithm to offer the advantages mentioned below:

- Appropriate workflow for dynamic learners whose behavioral alters over time.
- Mingling with people with same experience.
- Implements continuous learning.
- Assists classifications of learners styles.
- Supports the designers of instruction to offer the most proper design for their student communities.

In this model the author regards electronic learning services into main consideration. But this process can be used to different domains of business where dynamic composition is mandatory.

In¹⁶ presented the results of quantitative data analysis from responses of students' on post-task questionnaire. More specifically, students offered their feedback about the results of context-aware approach of adaptation. Similarly the contextual data of student was stored in files of log and they were examined along with their feedback, so as to recognize the context in which the adaptation was carried out. The feedback of students' was examined according to the following 3 dimensions such as adaptive learning activities delivery according to contextual information of learners (adaptation to the flow of learning); adaptive delivery of resources of education that assist activities of learning according to contextual data of learners' and adaptive delivery of services and tools that assist activities of learning according to contextual information of learners.

In¹⁷ presented a framework for an electronic learning content adaptation system that can be utilized with seamless mobile devices and desktops. An automatic system is evolved for the exhibition of learning materials on mobile gadgets. The system provides a service to acquire electronic learning websites based on particular device profile and learner. The experimental outcomes acquired are near-exact and offers a comfortable experience of learning for the user contrast to same antecedent approaches.

Chen and his research colleague examined the use of maps in contexts of m-learning¹⁸. For questionnaire's multi-choice part, many students choose Baidu Map Application on mobile devices as their desire and the usage frequency are twice or once/month. Additionally several number of students utilize map applications to predict their standing paths or location between two objects. There are major benefits and challenges of students' frequently-used map app for the open-end question part. The benefits of the maps is used to reside their places accurately and rapidly and the suggestions for way between two places are abundant; to study certain geography data; to navigate cars or themselves to the destination. The challenges of maps are that too much data displayed on small screen; Complex gestures to operate the interfaces of map and confusing functions of icon. Based on the outcome of this study, the students frequents used maps benefits can be regarded as opportunities for m-learning on maps in order to develop informal learning of students. To be exact, the application of map can support m-learning for students who are major in geography-related disciplines such as urban architecture or planning design. The students from geography associated disciplines required numerous tours with huge expense to support their formal studies. The applications of map create opportunities for mobile learning by offering a virtual tour without prices; ways between two points which help them find the solution and study the real world terrain and particular geographic information which assist their formal studies. Nevertheless, there are also some barriers for m-learning using maps. With challenges suggested from the views, how to exhibit exact and concise geographical data on small interfaces is an untoward problem which in outcome influences the proper users of information acquired from the m-learning process. Besides, confusing icons and complex gestures also might reduce the m-learning process on maps.

In¹⁹ carried out an investigation to examine the integration of context awareness system and situated learning for learning basic Chinese. Chinese was seen as the strongest language in the world. It is crucial to understand how to enhance teaching strategies and methods to efficiently assist non-native speakers for overcoming the barrier for language. With the e-learning and internets famous, technologies for learning have leaded both activities for learning and environment into the various dimensional worlds. In the present scenario, a new trend has developed such as context-aware

technology, to develop a environment for ubiquitous learning with features that entails problem solving practices and real life learning situations. The developed learning system for Chinese language would be able to assist foreign students for learning the language to rely on the interaction of system for augmenting their learning for language. It provides teachers practical chances for adopting the system and receiving extra information. In addition to these, it assists them assess students from various perspectives and provides them a profound understanding of their learners' unique learning styles. Further, it was clear from the analysis that pilot test outcomes indicated that these learners are highly fulfilled with the proposed system and their attitude in learning was positive when adopting such proposed system. Thus it can be concluded from the analysis that proposed system assists them assess students from various perspectives and provides them a profound understanding of their learners' unique learning style.

In²⁰ designed the system for adaptive learning based on the integration of e-learning and m-learning platform. This research gives the 1st stage of study, such as the designing the system for adaptive learning based on the integrating the e-learning system and m-learning system. Such system design would be covered for unique student environments and competencies. Development stage involves design, analysis, implementation and testing. Such system evaluation would be carried out by using feasibility study and software testing. Profile of the student would be given from the initial test for ensuring the learners to include their material and environment as their initial competencies. At the same time, it was noted that such system could be accessed using either mobile device or desktop based computer. Moreover, accessibility of such system flexibility could assist learners for maximizing their learning style.

3. Task/Method Concept

There are numerous studies and research that focused on the adaptive content learning. There are also studies and researchers that focused on enhanced learner model with specific reference to adaptive mobile learning¹⁰. Further, authors also discussed about the modelling and simulation of system for adaptive neuro-fuzzy interference with respect to mobile learning¹¹. In¹² carried out a research to examine the personalized adaptive electronic learning approach on the basis on the semantic web technology.

There are also researchers that concentrated on developing the adaptive learning system with various perspectives on the basis of student's cognitive styles and learning styles¹³. Authors in¹⁵ also concentrated on adaptive learning management system with specific reference to semantic web technologies. In addition to these, there are also researchers that discussed about the context-aware personalized and adaptive mobile learning delivery supported by UoLmp¹⁶. One of the research groups studied about the mobile-enabled content adaptation system for electronic learning websites with the help of segmentation algorithm¹⁷. Apart from these, another group designed adaptive learning system on the basis of collaboration of m-learning and e-learning system²⁰. However there has been no specific research that focused on designing and implementing an adaptive content m-learning system for learning and teaching with respect to basic Hindi. Therefore, this research attempts to bridge that gap by investigating in detail about designing and implementing an adaptive content m-learning system with respect to learning and teaching with specific reference to basic Hindi. This research will provide valuable insights to the students and significance of designing and implementing a system for adaptive content mobile learning for learning and teaching with specific reference to basic Hindi.

3.1 Hypothesis

Mobile devices are emerged as a technology with the ability for facilitating learning and teaching strategies which exploit individual context for learners¹. Personalization and adaptivity in system for mobile learning is the enabling process in the system to fit its functionalities and behaviour to the needs of education that is learning interests and goals, personal characteristics namely unique prior knowledge and learning styles and specific circumstances like present movements and location in the environment of group of interconnected students or individual students²¹. Further, there are two problems in the method of context-aware personalized and adaptive systems for mobile learning such as contextual information of learners that affects adaptations and adaptation type could be performed on the basis of contextual information of learner²². Therefore, this particular study intends to concentrates on designing and implementing an adaptive content m-learning system for learning and teaching basic Hindi.

3.2 Design and Implementation

The major purpose of the research was to design and implement an adaptive content m-learning system for learning and teaching basic Hindi. A method for design-based research was adopted for carrying out this research. To such need, review of literature was most significant process to frame the foundation of theory and design of structure design. Prior giving instructional strategies, it was crucial to rectify the challenges faced by exchange students who learn Hindi. Thus a design, analysis, implementation, development and evaluation process was adopted for designing and developing the learning system for Hindi language.

In the stage of system design was on the basis on the review of literature outcomes for planning the curriculum, developing strategies for instruction and designing a learning system for Hindi language. Based on the literature, interactive teaching characteristics are activities of student-centered for communication in real life, sociable situations. By including activities that is based on task has given to students are boosted to interact through different activities, finish tasks and enhance their potential to communications. Learning system for context awareness structure includes student's action with the user through interactive learning; technology of radio frequency identification to learners through the interactive platform process that records and directs metadata particularly in the database, mobile device gives feedback to learners; database forward strategies for learning and modes to the interface of user; interface for teacher; teachers could able to retrieve the learning styles of students with respect to database and teachers could assist students on the basis on their portfolios for learning.

3.3 System Architecture

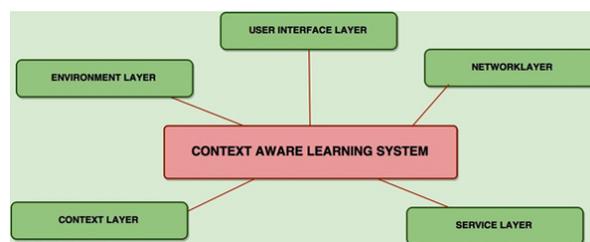


Figure 1. Architecture of context-aware systems.

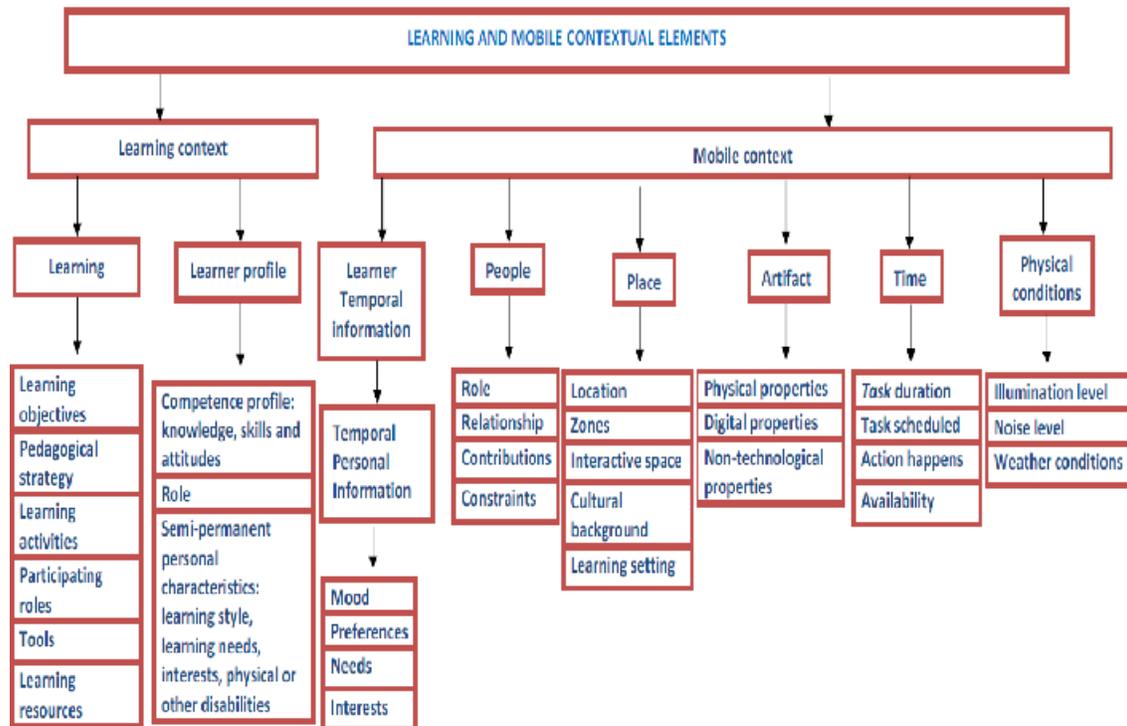


Figure 2. Architecture of learning and mobile contextual elements²⁴.

Context-aware techniques have been widely used in different domains, but still are limited to small scale environments due to the lack of an uniformly retrieve for exchanging context information. Context-aware Platform serves as a context information broker for accessing of distributed context-aware systems²³. The system architecture of the context-aware-system is shown in Figure 1. Context model combines with learning and mobile context. Learning context can be described by the elements of a particular learning design and the elements of the individual learner's profile. Additionally, mobile context can be described by the elements of: a. Learner's temporal information, b. Other people that influence the learning process, c. Current location, d. Technological artifacts and non-technological artifacts, e. Current time conditions and f. Physical conditions where the learning process is taking place²⁴. Figure 2 represent the architecture of learning and mobile contextual elements²⁴.

4. Discussion

The major purpose of the research was to design and implement an adaptive content m-learning system for learning and teaching basic Hindi. In this particular research, a method for design-based research was adopted

in order to carry out the study. It is expected from the literature that the interactive teaching characteristics are activities of student-centered for communication in real life, sociable situations.

It is expected from the literature that mobile learning system based on context-aware could maximize the interest and efficiency of learning as well as resolves the question of new-item at the time of adaptation. Apart from these, it is expected that significance of giving personalized interfaces for user for meeting the learning attitudes and preferences of students. In recent advances in mobile technology, researchers have begun to investigate language learning using various mobile devices such as smart phones, Tablets and Apple iPhones. These researchers often concern themselves with design features that capitalize upon WiFi access, Internet browsers, and text input. Most of these researchers have found that embracing the mobility and connectivity of mobile devices may lead to innovation in language learning for students across different environments²⁵. The wide use of mobile devices, such as smartphones, will provide a variety of educational opportunities to learners and instructors. However, various devices such as iPhones, iPads, and Android smartphones could rather be hindrances when providing educational services, as learners and instructors

wish to carry out teaching-learning activities using the devices they have, from the perspective of providing educational services, their needs have to be addressed²⁶. This investigation planned to develop an adaptive context-aware m-learning system for teaching and learning basic Hindi language. Hopefully, this basic Hindi language learning system will be able to help the students learn the unknown language by relying on the system's interaction to augment their language learning. It gives teachers a practical knowledge to use the system and receive extra information. It helps them assess learners from different viewpoints and gives them an in-depth understanding of students in different learning styles.

5. Conclusion

The study was planned to design and implement an adaptive content m-learning system for learning and teaching basic Hindi. In this particular research, a method for design-based research was adopted in order to carry out the study. It is expected from the literature that the interactive teaching characteristics are activities of student-centered for communication in real life, sociable situations. Thus it is essential that to design, analysis, implementation, development and evaluation process was adopted for designing and developing the learning system for Hindi language. It is expected from the literature that mobile learning system based on context-aware could maximize the interest and efficiency of learning as well as resolves the question of new-item at the time of adaptation. Apart from these, it is expected that significance of giving personalized interfaces for user for meeting the learning attitudes and preferences of students. Limitations of the research are this research is restricted to Hindi alone, findings of the study focuses only on the adaptive content m-learning system and this study completely concentrates on designing and implementing an adaptive content m-learning system with specific reference to learning and teaching basic Hindi.

6. References

- Jeng YL, Wu TT, Huang YM, Tan Q, Stephen JHY. The add-on impact of mobile applications in learning strategies: A review study. *Educational Technology and Study*. 2010; 13(3):3–11.
- Aroyo L, Dolog P, Houben G-J, Kravcik M, Naeve A, Nilsson M, Wild F. Interoperability in personalized adaptive learning. *Journal of Educational Technology and Society*. 2006; 9(2):4–18.
- Brusilovsky P. Adaptive hypermedia. *User Modeling and User Adapted Interaction*. 2001; 11(1):87–110.
- Mampadi F, Chen SYH, Ghinea G, Chen MP. Design of adaptive hypermedia learning systems: A cognitive style approach. *Computers and Education*. 2011; 56(4):1003–11.
- Wu W-H, Wu Y-CJ, Chen C, Kao H, Lin C, Huang S. Review of trends from mobile learning studies: A meta-analysis. *Computers and Education*. 2012; 59(2):817–27.
- Chen CM. Intelligent web-based learning system with personalized learning path guidance. *Computers and Education*. 2008; 51(2):787–814.
- Hsu CK, Hwang GJ, Chang CK. Development of a reading material recommendation system based on a knowledge engineering approach. *Computers and Education*. 2010; 55(1):76–83.
- Papanikolaou KA, Grigoriadou M, Magoulas GD, Kornilakis H. Towards new forms of knowledge communication: The adaptive dimension of a web-based learning environment. *Computers and Education*. 2002; 39(4):333–60.
- Zhao X, Anma F, Ninomiya T, Okamoto T. Personalized adaptive context system for context-aware mobile learning. *IJCNS*. 2008; 8(8):153–61.
- Al-Hmouz A, Shen J, Yan J, Al-Hmouz R. Enhanced learner model for adaptive mobile learning. 2010 Proceedings of the 12th International Conference on Information Integration and Web-based Applications and Services, IIWAS'10; 2010. p. 783–86.
- Al-Hmouz A, Shen J, Al-Hmouz R, Yan J. Modeling and simulation of an Adaptive Neuro-Fuzzy Inference System (ANFIS) for mobile learning. *IEEE Transactions on Learning Technologies*. 2012; 5(3):226–37.
- Yarandi M, Jahankhani H, Abdel-Rahman HT. A personalized adaptive e-learning approach based on semantic web technology. *Webology*; 2013. Available from: <http://www.webology.org/2013/v10n2/a111.pdf>
- Yang TC, Hwang GJ, Yang SJH. Development of an adaptive learning system with multiple perspectives based on students' learning styles and cognitive styles. *Educational Technology and Society*. 2013; 16(4):185–200.
- Verhoeven L, Schnotz W, Paas F. Cognitive load in interactive knowledge construction. *Learning and Instruction*. 2009; 19(5):369–75.
- Begam F, Ganapathy G. Adaptive learning management system using semantic web technologies. *International Journal on Soft Computing*. 2013; 4(1):1–8.
- Gomez S, Zervas P, Demetrios GS, Fabregat R. Context-aware adaptive and personalized mobile learning delivery supported by UoLmP. *Journal of King Saud University-Computer and Information Sciences*. 2014; 26(1):47–61.
- Coondu S, Chattopadhyay S, Chattopadhyay M, Chowdhury SR. Mobile-enabled content adaptation system for E-learning websites using segmentation algorithm. 8th International Conference on IEEE Software, Knowledge, Information Management and Applications (SKIMA); Dhaka. 2014. p. 1–8.

18. Chen K, Liang HN, Fleming C, Man KL. An investigation of the use of maps in mobile learning contexts: Possibilities and challenges. *International Conference on Platform Technology and Service, (PlatCon); Jeju*. 2015. p. 35–6.
19. Ku DT, Chang C. Integration of situated learning and context awareness system for learning basic Chinese. *Journal of Software*. 2013; 8(9):2106–13.
20. Hariyanto D. The design of adaptive learning system based on the collaboration of m-learning and e-learning system. *Journal of Advances in Computer Networks*. 2014; 2(4):311–4.
21. Wu S, Chang A, Chang M, Liu TC, Heh JS. Identifying personalized context aware knowledge structure for individual user in ubiquitous learning environment. *Proceedings of the 5th International Conference on Wireless, Mobile and Ubiquitous Technologies in Education, (WMUTE 2008); Beijing, China*. 2008. p. 95–9.
22. Graf S, Kinshuk. Adaptivity and personalization in ubiquitous learning systems. *Proceedings of the Symposium on Usability and Human Computer Interaction for Education and Work (USAB 2008), International Workshop on Adaptivity and Personalization in Ubiquitous Learning Systems; 2008*. p. 331–8.
23. Hsu CI. An architecture of mobile web 2.0 context-aware applications in ubiquitous web. *Journal of Software*. 2011; 6(4):705–15.
24. Sampson DG, Zervas P. Context aware adaptive and personalized mobile learning. In *3rd International Conference for E-Learning and Distance Education; Riyadh, Saudi Arabia*. 2013.
25. Tai Y. Contextualizing a MALL: Practice design and evaluation. *Educational Technology and Society*. 2012; 15(2):220–30.
26. Lee DH, Shon JG, Kim Y. Design and implementation of OSMD based learning management system for mobile learning. *Indian Journal of Science and Technology*. 2015; 8(S1):154–60.