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A COMPONENT-BASED FRAMEWORK FOR DEVELOPING EDUCATION SOFTWARE
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Modern software requires appropriate software development methodology for both software developers and end users. The developers need a methodology that has a shorter development time and at the same time guarantees that the software being developed is up to standard, robust, and reliable. The end users need software that is easy to use and tailored to their specific needs. This dissertation proposes a systematic approach for developing educational software on Internet and World Wide Web (WWW) environments using component- and framework-based technologies. The approach requires full understanding and thorough analysis of the educational domain of interest along with creating and applying suitable models.

The systematic approach includes the following 5 steps: (1) analysis of the specific educational problem domain, (2) identifying a model to solve the problem(s) within the domain, (3) developing the vertical framework using appropriate software development technology, (4) implementation of a prototype based on the vertical framework, and (5) evaluation of the user feedback to the prototype and use its results to develop a better version of the educational software tool using the proposed model.

The dissertation discusses that current educational software is mostly based on different and complicated teaching and learning models. This requires the teachers and students to adapt to different models by changing their teaching and learning styles. The proposed new model, Question and Answer (Q&A), is an attempt to solve this problem. The model is based on the fact that asking and answering questions sessions exist in most learning and teaching styles and by applying Bloom's taxonomy of learning in the cognitive domain into the model, a qualified questioning strategy is formed. As a result, teachers and students can apply this model, which is based on a format of a question paired with answers, to fit their current teaching/learning requirements.

The software built using the methodology proposed in this dissertation uses the component- and framework- based technology called Q&A framework. It is a vertical framework designed specifically for Q&A teaching and learning processes carried out on the Web computing environment. The Use Case analysis method is used to identify the five components of the framework, namely (1) QuestionSkeleton, (2) QuestionSelect, (3) Answer, (4) TeacherInterface, and (5) StudentInterface. They stem from and correspond directly to the Q&A pedagogical model with a special pattern used to link those components in a specific way according to the Q&A model. The component's interfaces are also derived from the functionality of the Q&A model.

A prototype version of the model was developed using the Internet and WWW technologies to prove its application in a flexible classroom-like learning environment. This new environment is described and is called distance-less learning. It suggests how the constraint of time differences existing in the distance learning environment can be solved.

The prototype is applied in a real classroom environment. The feedback from the users of the prototype is positive with recommendations made regarding the diversity and richness of the information accompanying both questions and answers. The recommendations will enhance the development of the next version of the tool. Currently, the Q&A model and the framework is now an implementing system used in Asia IT&C project, which is funded by the European Union (EU).

Contributions of this dissertation include a combining of the Q&A model for distance-less learning and software development technologies, the Q&A component-based framework model, component specifications, interface specifications, and the implementation technique. The direct benefits for students include (1) students can always ask questions and always receive the answers, (2) students do not need to change their styles of learning, (3) students can improve thinking by questioning effectively, and (4) Students can propose new questions and/or new answers and discuss them with teachers. The direct benefits for teachers include (1) teachers can have good questions to ask students covering all levels of learning in the cognitive domain, (2) teachers do not need to change their styles of teaching, (3) teachers can modify the questions and answers, and (4) teachers from other institutions who have experience teaching similar courses can share and improve the questions and answers.