

# Chapter 19

## A Kinect–Based Assessment System for Smart Classroom

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### ABSTRACT

*With the advancements of the human computer interaction field, nowadays it is possible for the users to use their body motions, such as swiping, pushing and moving, to interact with the content of computers or smart phones without traditional input devices like mouse and keyboard. With the introduction of gesture-based interface Kinect from Microsoft it creates promising opportunities for educators to offer students easier and intuitive ways to interact with the learning systems. The integration of Kinect based applications into classroom make students' learning experience very active and joyful. In this context, this paper proposes a system for assessment in a smart classroom environment. An interactive framework is designed using Microsoft Kinect sensor for virtual learning environment with new gesture-based questions supporting QTI-based assessment, and further a rich set of gesture commands are also introduced for practical usage in the classroom. Proposed system was experimented with teachers and students then collected feedback of the users using a usability questionnaire. The results show that the participants are satisfied with the system and it demonstrates that the proposed system is simple to use, provides better functionality and motivates student learning by assessment.*

### 1. INTRODUCTION

With the time, the types of user interfaces people use to operate their digital tools are changing. Handheld devices, retinal trackers, speech recognition and gestural interfaces are becoming popular and famous, and are starting to become widely adapted for students' learning. These advanced tools are now challenging content developers to take advantage of new levels of interactivity between students and teachers.

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Microsoft Kinect is a highly versatile, mobile, and accessible learning tool with numerous applications (Microsoft, 2013). Teachers and program coordinators can tap a fast-growing portfolio of games that spans across academic disciplines, sports, and adventure scenarios to energize classroom and after-school activities. Educators can also take advantage of Avatar Kinect to pursue unique opportunities for intra-school competitions, distance learning, and collaboration with colleagues, students, and parents.

Another important concept of automatic tests is the assessment, the process of documenting, usually in measurable terms, knowledge, skills, attitudes, and beliefs. Assessment can focus on the individual learner, the learning community (class, workshop, or other organized group of learners), the institution, or the educational system as a whole. However, despite the benefits of automatic tests using traditional types of questions (e.g., multiple choices, multiple response or fill in the blank) it is difficult to assess higher-order skills such as, problem solving, problem exploration, collaboration, creativity, discovering rules, developing effective strategies, spatial or time perception, among others. IMS Global provides specifications for assessment, named IMS question and test interoperability (QTI) (IMS Global Learning Consortium, 2013). The benefits of QTI are its easy manageability since it is built on XML, and its support in reusability, adaptability, scalability, and interoperability with other languages and systems. The aim of QTI is to provide an interoperable data model for the representation of questions, their aggregation in tests, and the definition of sophisticated ways of producing outcome reports for the whole test. These tests can be created and realized by compliant systems. A QTI compliant editor (used by a teacher) will turn the test and questions into a set of XML files containing all their information. Similarly, the students' interactions and answers can be visualized with a QTI compliant player.

Standing on the aforementioned background, the proposed research here has three major components, which are, QTI based assessment system, virtual learning environment, and gesture detective mechanism. The developed system aims to provide a friendly way for kids to answer questions in an interesting way. Although there is no much evidence in the literature on how to combine QTI into the gesture-based answering system, by doing this work, we believe the proposed system will be useful and appreciated by the users. Our system is different from the main stream researches in the game-based learning (GBL), from GBL's usual goal of sophisticated instructional design principals inside the game; rather, we try to provide a complete system to let instructors to design simple tests. With respect to the research stream of using gesture-based training supports in physical exercises, the proposed system, instead, is for general users to answer interactive questions. The developed system does not replace any existing assessment systems; instead, it encourages younger students to play with the system, and to answer the questions in an intuitive way. The system can be used in some unofficial situations, such as in a general customer reception area, or in a playground for kids. We believe complex assessment can still be used in traditional tests, which cannot be replaced by our method. Rather than focusing on new educational theory, existing general learning and testing theories can also be justified by using our mechanisms, which is planned in future works. Further, the demonstrated tool is a practical system for public to use, with no limitation in the usage to fit any existing learning or assessment theory.

In summary, this paper presents, discusses and analyses several evidences that shows how innovative technologies can be used in QTI system, in different scenarios, and analyzes the suitability of using QTI at the end. In this context we developed new tools and implemented real scenarios for smart classroom with Kinect. To use the proposed system for assessment with Kinect, first, the teacher creates course content and questions, then, the student can use own hand gestures to answer the questions provided by the teacher in smart virtual classroom with Kinect based interface. This global aim is divided into a set of specific objectives as, teacher's authoring tool to create and edit course and questionnaires, monitor

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