Affordances of an innovative ecosystem of multiple tabletops and Anatomy resources for supporting collaborative practical learning

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Abstract: This article explores the components of an innovative ecosystems consisting of networked multiple tabletops, Anatomy and other medical resources within a practical lab environment. The affordances of multi-touch tabletops as well as those of the other components of this novel ecosystem is discussed in terms of supporting collaborative and active learning in large cohorts with few facilitators. An analysis of their key design features and capabilities is also discussed. The potential impact of this ecosystem onto various types of learning are identified which strongly support their integration in learning space to support practical learning as well as 21st century skills for our next generation students.

Keywords: Collaborative learning, Multi touch Tabletop, Affordances, Active learning, innovative ecosystem, Anatomy practical learning

Introduction

Tabletop computers or multi-touch interactive displays, commonly referred to as tabletops, are increasingly being used in a broad spectrum of learning environments to engage groups of learners as well as support various interactions through digital technology (Lucia et al, 2009). Literature on tabletop affordances usually relates to those that support learning within the confines of the tabletop itself. This may not be sufficient to simultaneously engage multiple groups of students in a large cohort. To meet this challenge, an innovative ecosystem of tabletops has been designed for our Anatomy practical learning and comprises of networked student tabletops, teacher tabletop, Anatomy models/specimens, student groups and facilitators - all integrated within a practical lab space.

1. Active learning and Collaborative Learning

Collaborative learning enables solving problem/tasks with active contribution from all members. Tabletops, through its multi-touch capabilities, offer unique ways to engage students to share, manipulate and annotate digital contents/media while discussing, understanding or peer learning/teaching a concept. During active learning, a term encompassing collaborative learning, students are engaged in building and understanding facts, concepts, and skills through the completion of tasks and activities. However in medical education, this is often limited to adoption of interactive techniques and case based learning (Graffam, 2007).

2. Learning Design Of Ecosystem Of Tabletop and Anatomy Resources

In our School of Medicine, for active learning of human Anatomy and its related clinical applications, we have designed an innovative ecosystem of tabletops, digital anatomy resources, gross anatomy and histopathology resources integrated through a classroom technology. The components of the ecosystem are: (A) Student tabletops with preinstalled computer assisted anatomy software and a novel collaborative software (designed and produced by our industry partner Smart Surface Sdn Bhd) for groups of 8-10 students (B) a "demonstration console" with video camera, document camera, microphones, a teacher tabletop, examination couch etc. for practical skills demonstration (C) Multiple data projection screens to broadcast streams from the "demonstration console" (D) Anatomy resources - plastinated (dry) human cadavers, Anatomy models, skeletons and (E) Clickers.

The uniqueness of this ecosystem is the integration of digital media and collaborative technologies (through tabletops) with physical discipline based resources (models/specimens).This brings about a seamless transition from hands-on experience to collaborative learning to student research, juxtaposed with feedback, demonstration and guidance from the facilitators.

A seamless communication between the networked student tabletops and the teacher tabletop is achieved through the above mentioned collaborative software as an application over the tabletop operating system. It encompasses multi-user desktop interface with customized keyboards for note taking, annotations (on images), web browsers and content streaming etc. The teacher's tabletop has controlling/monitoring interface for contents streamed from it as well as a messaging system for receiving and responding to students' queries in real time.

Thus, within the same lab, guided by practical tasks, hands-on exploration of a physical Anatomy model such as a knee joint is seamlessly extended to identification of its parts through a labeled digital image followed by critical discussion of its functions by viewing an animation of knee movement via the tabletop. Students next simultaneously explore a plastinated knee specimen and a Magnetic Resonance Imaging (MRI) scan to collaboratively understand how anatomical knowledge relates to radiological imaging thus seamlessly moving between visual, auditory and kinaesthetic learning modalities. During this process they can message any queries to the teacher tabletop and obtain feedback. Such an innovative ecosystem thus has a varied and rich source of educational affordances.

3. Affordances

Affordances originally referred to "*just those action possibilities that are readily perceivable by an actor (user)*" (Norman, 1999). However, according to Gaver (1996), affordances exist whether or not the actor perceives them. Technological affordances are the quality of technology, such as communication, collaboration, multimodality etc., which allows learners to learn (Conole & Dyke, 2004). Combining verbal, non verbal, academic, social and digital interactions, tabletops create an environment for engaging in collaborative knowledge building.

3.1Affordances of ecosystem of multiple tabletops within a Anatomy resource centre

Our new ecosystem not only supports active learning but also lead a classroom orchestration of interactivity and networking of multiple student groups along with the

facilitators. Here we discuss the intrinsic affordances rather than the perceived ones. Anatomy learning is dependent on 3D conceptualization of the human body for which tabletops can acts as cognitive tools allowing several students to simultaneously explore and manipulate digital Anatomical image/objects as well as perform independent student web search. Its situation within an Anatomy resource centre, such as ours, extends its affordances to simultaneous multimodal interaction amongst students, facilitators, Anatomy models as well as digital content. It thus allows for multimodal representation of content, instructional procedures, ways of student-centered discovery and multiple ways of student interactions. It appeals to visual, kinesthetic and auditory senses for an all-round student experience while producing more effective gains in higher-order learning. Varied forms of visualizations of the world's most complicated structure – the human body, make Anatomy learning attractive, motivating and comprehensible for aiding deep learning.
This ecosystem is in tune with the constructivism paradigm that allows engagement in an activity that utilizes the content and skill that the students are learning.

The social affordances (creating a social space amongst group members) of our ecosystem includes both face to face interactions as well as social media accessible via the tabletops. Different media *forms* have different affordances (Laurillard, 2002). Our ecosystem includes all varieties of media forms to provide a rich and varied learning experience: *Narrative media* e.g. image/description of an Anatomical structure; *Interactive media* e.g. computer assisted anatomy modules; *Communicative media* that facilitate exchanges between teacher and student tabletops; *Adaptive media* e.g. for annotating pictures and *Productive media* e.g. production of schematic diagrams or a power point slides for sharing.

4. Conclusions and Implications

Our new ecosystem supports various types of learning (Naismith et al, 2004). It encourages *behaviorist learning* through real-life clinical scenarios streamed from the teacher tabletop, *constructivist learning* while clinical anatomy videos are presented for critical analyses, *situated learning* where student peer teaches clinical skills using the demonstration console (authentic context), *collaborative learning* whereby students manipulate the digital contents and *lifelong learning* where they learn web based search. This ecosystem has promise in promoting active practical learning as well as developing 21st century skills of handling information, problem solving, collaboration etc. (OECD, 2010).

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