

How can Communities of Practice and UMI technologies support and enhance STEM learning

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Abstract. Recently there has been a rise in research focused on the use of Communities of Practice (COP) in Education. The aim of my research is to investigate the role a COP and technology can play in stimulating the learning of STEM subjects in second-level schools. The central objective here is to explore the use of UMI technologies (Ubiquitous computing, Mobile technology and the Internet-of-Things), alongside the current STEM curricula to enhance learning in the classroom and to strengthen the communication between members in a COP. To achieve this, my research approach will incorporate a participatory design process and group evaluations. I will collaborate closely with a number of local schools, where design workshops and user studies will be conducted continuously over the course of this research project.

Research Context and Motivation

I am a funded PhD student at Cork Institute of Technology, Ireland and I am currently nearing the end of my first year of a 4-year full-time program. The proposed program of study is situated in the field of Communications Technology but at the intersection of Human-Computer Interaction and Interactive Design. My research is funded by UMI-Sci-Ed [1], a European Union Horizon 2020 funded

¹ <http://umi-sci-ed.eu/>

project and it is also supported by the *Teacher of Things* project². My research is based on the belief that a COP, comprising of STEM practitioners, including teachers, researchers, experts, and industry partners can enhance STEM learning through regular interactions and collaborative problem solving.

COP are widely used across many different domains, and although they have actually been around for as long as humans have learned together, the term is not widely recognized (Wenger, 1998). In the literature COP have different definitions and descriptions, as well as being called by many different names, including Community of Practitioners (Gherardi, 2006), Knowledge building communities (Hoadley, 2012), Professional learning communities (Blankenship, 2007), Communities of Interest (Henri & Pudelko, 2003) etc. The current focus of my research is to develop a definition of COP, which is relevant to my research but is also broad enough to the wider research community.

Thesis Statement and Research Goals

To date, the majority of published research uses different definitions for the term COP and how they operate within larger organizations. A goal of my research is to fill the following research gap which is to understand how a COP can be used in education in order to help to enhance STEM learning for second level students. My research will attempt to fill this research gap in order to support work that seeks to build a COP that works towards the future of education. Presently, I have number of preliminary questions that are key to charting the course of my research: (1) What defines a Community of Practice?, (2) How can we develop and engineer a successful Community of Practice?, and (3) How do we engineer a COP by exploiting technologies and tools to enhance a range of potentially very different teaching practices for STEM?

Research Approach

My research approach will combine conducting workshops in a range of COP, and developing findings through the use of qualitative research methods. The purpose of this research approach is to explore how a COP works and to get insight into what forms of communication they use to achieve their goals. I am currently working on the first work-package of my research, a case study that aims to answer the broad research question: what defines a COP? This work-package is divided into five phases extending over an eight-month period (January – August 2017)

² <http://www.teachersofthings.ie>

Research to date

Over the past six months I have been working on the first phase of my work package (described above), by carrying out an extensive review of COP literature, reviewing papers from each year starting with 1991 when the phenomenon was first introduced by Lave and Wenger (1991) where they studied apprenticeship as a model for learning and working towards the current day research. From the literature, I have extracted fifteen COP definitions, and through a process of thematic analysis I identified key words and phrases commonly use in these definitions. I am currently categorizing these words and phrases so that I can establish a definition of a COP, which can be used to evaluate against any COP across any domain in which it is situated. Based on my analysis of these varied definitions I have established the following working definition of a COP, which I will use in the context of my research: *“A Community of Practice is a group of practitioners who share expertise in a common domain. Members of a COP go through a process of legitimate peripheral participation, collaboration and building up a shared repertoire of resources and experiences in their given domain.”* I am also actively working on phase 2 and 3 of my case study, which will involve developing a COP characteristic Matrix and I have actively sought out Coderdojos requesting to conduct semi-structured interviews with the organizers. I have eight Coderdojos interviews completed and I am currently in the process of analyzing these.

Expected outcomes from attending doctoral colloquium

Following the conference I plan to disseminate the results of my case study to an appropriate conference. I will then begin work on my next study, which will focus on interacting with teachers by conducting semi-structured interviews. From attending the Doctorial Colloquium, I hope to get senior advice on how to strengthen and perhaps improve future studies based on the outcomes from my first case study. Recommendations and feedback on the methodological approach I have planned for future study designs are highly appreciated.

Expected Contributions

Recently there has been a dramatic rise in the amount of research focusing on the use of COP in Education (Hou, 2015; Jakovljevic, Buckley, Bushney, 2013; Rio, Juan, 2012). However, a research question that seems to be somewhat overlooked is: *how can similar COP collaborate and work together on a common goal?* In the case of my research: *to stimulate STEM learning for students in second level education.* This work intends to address this research gap by providing guidelines for the design of such communities with the use of UMI technologies (Ubiquitous Computing, Mobile Computing and the Internet of Things) to enhance the STEM learning but also to improve the communication methods between members in a COP.

Biography

Michelle O'Keeffe is a First Class Honors Graduate of BA (Hons) in Multimedia at Cork Institute of Technology, Ireland (2015). Her final year project was to design and develop an artefact that could be used to enhance a child's experience of a heritage center or museum. She worked in a group with two others to create "Puzzlebeo", an interactive, multimodal jigsaw puzzle and interactive wall nodes which were designed for use in the Titanic Heritage Centre in Cobh, Co. Cork. She was responsible for the user testing and the user evaluation as part of the project. This was when she developed a key interest to research this area of evaluation and pedagogy further.

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