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研究課題名（英文）Exchange For IT Education in Japan

研究代表者
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研究成果の概要（和文）：2012年に、CS2013のガイドライン、CSEE&T、およびISERN会議での活動に従事していました。これは、2013年から2014年まで続きました。主な結果として、教育学とソフトウェア工学に関する情報を収集し整理するためのウェブサイトの開発をしました。私はまた、この期間中にCSEE&Tのための運営委員会の議長に選出されました。また、ISERNの共同プログラム委員長にも選出されました。

研究成果の概要（英文）：In 2012, I was involved in work on the CS2013 guidelines, CSEE&T, and ISERN conferences. This continued through 2013 and 2014. The main additional result was the development of a website for collecting and organizing information about pedagogy and software engineering.

研究分野：　教育学

キーワード：　教育学　ソフトウェア工学

１．研究開始当初の背景

The basic roots of this study lie in the concern over what and how we are teaching students as software engineering. There are many studies of pedagogy, at various ages, and models of just how teaching and learning occur. In addition, we have various guidelines about what to teach in the software engineering field.

However, questions about just how well our teaching methods work, and how they apply to the software engineering domain, are still very active. Does lecture, homework, and test really do an adequate job of teaching the fundamentals of software engineering? Or are more active methods, projects and active learning, more appropriate?

２．研究の目的

I planned to examine the literature, attend conferences, and conduct interviews and perhaps surveys of software engineering faculty in Japan, to provide a systematic review of the pedagogical approaches described in the literature, being discussed in conferences, and in actual use.

The goal was to provide a web-based resources describing pedagogical approaches, software engineering, and the state-of-the-practice.

３．研究の方法

There were three main research methods.

First was a systematic literature review, examining the pedagogical and software engineering literature.

Second was attending conferences, to determine the curriculum guides and methods of pedagogy being proposed or used.

Third was interviewing and perhaps surveying Japanese software engineering faculty to capture their viewpoints.

４．研究成果

In 2012, I was deeply involved in review and comments on the CS2013 curriculum guidelines. Also that year, I was elected to chair the steering committee of the Conference on Software Engineering Education and Research. In April, 2012, I conducted a workshop on the draft Computer Science 2013 guidelines, and a panel session examining future research directions for software engineering education and training. In June, 2012, I attended the International Conference on Software Engineering which had several sessions on Software Engineering Education. Then in September, 2012, I attended the ISERN meeting, where we created a list of unsolved problems of software engineering, looked at ways to foster collaboration, and developed a recommended core reading list. I also began experimenting with a prototype website that year, trying to determine what functions were needed.

The panel session at CSEET 2012 identified six areas we believe to be important for future research on software engineering education and training. First, can the results be used in industry? Second, what do people actually know or understand? Third, what are the specializations within software engineering? Fourth, what are the best teaching methods for rapid learning? Fifth, what do students really need to have "in their head" versus information that is available "just-in-time" from online or other aids? Sixth, software engineering is skill-based, how does this change the teaching methods?

In 2013, the key focus was on being the chair for CSEE&T. In addition, I was elected to be the co-program chair for ISERN, which resulted in being involved in organizing the program for 2014.

In 2014, there were four major achievements. First, the website was opened to the public in October, 2013, and has continued to be expanded (https://sites.google.com/site/cseet2014improvingtheprocess/). Second, as chair of the steering committee for CSEE&T, I conducted a workshop on improving the submissions process. I was also a member of a panel on Industrial Needs and Educational Response. The third major achievement was organizing the ISERN program, and especially developing an online wiki to collect information about

collaborations in that group. Finally, I was invited to comment on the draft Software Engineering Competency Model (SWECOM).

In the workshop at CSEET 2014, we identified four major recommendations for improving the submissions process to our conference. First, we need to collect empirical data about submissions, both from those who participate and those who do not. Second, we should promote themes with an evangelist for each one, on both a yearly and long-term basis. Third, we need to focus on the value proposition for the community and participants, increasing the payoff for individuals and networking for the community. Fourth, we need to promote the unique aspects of CSEE&T, focusing on education and training.

As part of the ISERN 2014 program, I helped create and use a system for collecting information about research collaborations using a wiki-based forms system and the NodeXL system for analysis of social networks. This will provide a continuing method for collecting this information at ISERN, and the NodeXL network allows us to quickly see the patterns of the social networks of research collaboration in this community. The resulting network is shown below in Figure 2.

At this point, I believe that the best approach for software engineering pedagogy will grow out of a combination of three different approaches from different areas. First, from the pedagogical realm, we have constructivism, which is a theory built around the model of each student constructing their own knowledge, their own framework and understand, based on their experiences and ideas. In this framework, the teacher acts as guide or coach, sometimes selecting and providing opportunities for experiences, but the main focus is on the student as active learner. This approach seems to me to match the skill-based domain of software engineering, where there is information to learn, but much of the content is created from experiences, rather than from memorizing and repeating information. As part of this, I think the recent growth of so-called flipped classes holds strong promise. In such classes, the lectures and knowledge of the professor are provided using videos or other online formats for the students to digest outside of class at their own pace, while the face-to-face class time is used for discussion and active homework or other student-focused work, giving them opportunities for more experience with the professor as expert guide and coach.

Second, from the psychological interpretation of education, we can borrow the model of metacognition or reflective thinking. The key here is the model of learning as involving thinking about thinking, conscious planning, monitoring, and evaluation of the process of learning by the learner. Selecting when and how to use particular strategies for learning or problem solving fits well with the model of the student constructing their own learning.

Third, it seems to me that communication models or skills need to be considered when thinking about learning. The basic skills of encoding and decoding communications, the more advanced skills of organizing ideas and concepts and presenting them, and other communication skills are critical parts of the educational process that are often ignored. This is where the teacher and students meet and form the learning community that creates the experiences used for reflection and construction of understanding, and the methods, verbal, visual, and other modes available now, need to be considered.

Figure 1. IT Education in Japan Website

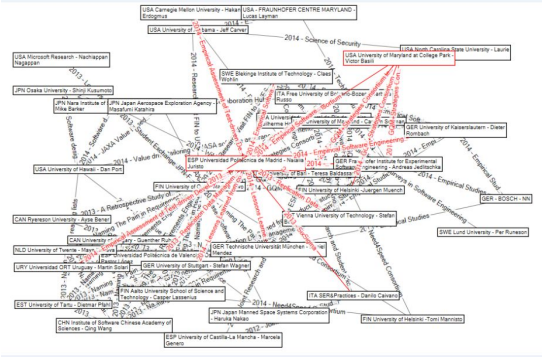

Figure 2. Social Network Analysis of ISERN Research Collaborations

５．主な発表論文等

（研究代表者、研究分担者及び連携研究者には下線）

〔雑誌論文〕（計１件）

① Mike Barker, “Workshop on Improving the CSEE&T Submissions Process”, SOFTWARE ENGINEERING EDUCATION AND TRAINING. IEEE CONFERENCE. 27TH 2014. (CSEE&T 2014), **査読有**, 27, 2014, 183-186
978-1-4799-4970-0/14

〔学会発表〕（計６件）

① Mike Barker, Barbara Russo, “Drawing the ISERN Community”, ISERN 2014, September 14-16, 2014, Torino (Italy)
② Mike Barker, Barry Boehm, Markus Clermont, Marcus Hassler, Roland T. Mittermeir, “Panel Session on Industrial Needs and Educational Response”, CSEE&T 2014, April 22-25, 2014, Klagenfurt (Austria)
③ Mike Barker, “Workshop on Improving the CSEE&T Submissions Process”, CSEE&T 2014, April 22-25, 2014, Klagenfurt (Austria)
④ Mike Barker, “Panel Session: Research Directions for Software Engineering Education and Training”, CSEE&T 2012, April 17-18, 2012, Nanjing, Jiangsu (China)
⑤ Mike Barker, “Workshop: Exploring the Computer Science 2013 Curriculum Guidelines”, CSEE&T 2012, April 17-18, 2012, Nanjing, Jiangsu (China)
⑥ Mike Barker, “Talking in a Typhoon: Communications in the Digital Revolution”, ISCAS Research Exchange, September 11, 2012, Beijing (China)

〔その他〕
ホームページ等

IT Education in Japan
https://sites.google.com/site/iteducationinjapan/home

６．研究組織

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