Developing A Blended Learning Course for Chinese Computer Science Students

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We developed a blended course for Chinese computer science undergraduates at the 3rd year level in cooperation with Shantou University (STU) and the generous support of the Li Ka-Shing Foundation. To this point the students at STU had mostly been taught rotely, sitting passively in a classroom listening to lectures and taking tests that had not adequately fostered initiative, invention and problem solving ability. Our goal has been to improve teaching and learning so the students acquire a deeper understanding of the material [2] and feel empowered to think boldly and outside their teachers' expectations while they learn and solve problems [5]. In the first year we designed a teaching approach that involves more personal and active interaction with teachers and peers. For the second year we added nine weeks of online content and a project week at the end, thus making the course blended. Our challenge has been to keep the course personal and active while adding online content. In order to keep students engaged we use the first week for students to connect and be prepared for the online content. During the online period we have weekly online meetings. Finally, the project week at the end to affirms the students have acquired the online content. We want to scale not only over time but also in size and have thus started to shift some of the active learning online we have prototyped online versions of activities we taught in person.

The course, EPS101@STU [1], teaches an abstracted view of evolution as an adaptive process of improvement fundamentally dependent upon population-based selection, and replication with variation. Students learn to recognize evolution in action around them in systems other than biological ones and to see how it guides adaptation toward intelligent systems. The abstraction is then connected to computation, artificial intelligence and genetic algorithms by the students learning how software-based strategies for a simple digital game called TRON/Snake can be evolved and improved via a distributed genetic algorithm.

EPS101@STU was developed over three years, with each year providing experience toward the next. (1) *2013*: we taught a week long pilot that focused on core content and teaching methods. We taught in a highly personal and interactive manner to help students acquire knowledge in a manner new to them. We used (i) class games, e.g. students played different Prisoners Dilemmas strategies and accumulate their payoffs and then we used the payoffs as "fitness" in a round of evolutionary selection and reproduction (ii) think-pair share, e.g. after providing an example of LINUX innovation through evolution, students independently think about other examples, pair to exchange ideas and finally share with the class (iii) active learning [3], e.g. students learn sexual selection via a "mating" game, in which they experience the effects of sexual

[1] `http://groups.csail.mit.edu/EVO-DesignOpt/EPS/`

characteristics on mate selection and offspring quantity [2] (2) *2014*: we doubled the class size and increased the length of the course to 12 weeks adding nine week set of online lectures via the openEdX [3] platform and a "climax" week for team-based projects in the classroom to reinforce course principles. The openEdX material was mostly video-based and covered concepts and software descriptions. With the final projects students refined their new knowledge by developing new user experience, systems or genetic algorithm capability. The format of a sandwich of two interactive personal weeks with an online module in between is scalable because the course could be staggered to admit a new small class each week or the first and last weeks' material could be taught multiple times daily to different student sections. (3) *2015*: we designed and implemented prototype education technology that might eventually be a substitute for in-class learning exercises. This was introduced supplementally to classroom exercises and the students even helped improve it as class projects. We found similar issues as in [1] in year two and increased the teacher interaction during the online part.

One meta-level aspect of the course was prompting reflection by the students on how they were learning [6]. Online learning is free and self guided and it allows the student to learn whenever and wherever at their own pace. We asked the students to reflect on the contrast of online and classroom learning. They commented on (a) their lack of discipline overshadowing the flexibility (b) the use of private online chats instead of the discussion forums, the TAs attributed this to fear of revealing weakness to the teacher. Finally, by working in teams on projects we provided the impetus for reflection on the power and challenges of team work and the real-world issue of scoping down an open-ended problem.

The students enjoyed the course, for each year 95%, 97% and 94% said they would recommend it to a friend. In 2015, during the online module, weekly in-class meetings held at STU by TAs with an American teacher participating remotely greatly improved online activity, when compared to 2014. The class size of 32 in 2015 was 1.5 times that of 2013 and the content increased from 2013 to 2014 in its level of complexity. The STU CS department has committed to teach the course next year in Chinese while transitioning the teaching material gradually from English to Mandarin.

References

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