Design of Computational Thinking Course for College Freshman in Residential education

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Synopsis:

Since 2013, Yonsei University extended the higher education in Residential College at international campus, and students live in and interact with a diverse community. Up to now, computer education is narrowly focused on teaching the computer programming languages for mostly science & engineering students. Creativity and Problem solving skills is getting needed for everybody, and then we make it to broaden for all of the freshman year students.

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I.   Background

In 2012, Yonsei University started Residential College (RC) education at the Yonsei International Campus in Incheon, where freshman students live in and interact with a diverse community in their freshman year. The University College of Yonsei University is in charge of the RC education, which has been evaluated to be more than just a success story for undergraduate education. Yonsei RC has been appraised as a new model for Korean post-secondary education.

The goal of a project is to design and develop a Computational Thinking (CT) course for freshman students in the RC environment. The course will be designed to teach problem solving skills to RC freshmen majoring in any discipline who may be mathematically underprepared. We will focus less on computer programming and more on problem solving and critical thinking. Specifically, a standard CT course will be designed based on a thorough review on the current CT practices. This project also develops an efficient and effective teaching method, which enables students with diverse perspectives and multidisciplinary backgrounds to learn how to develop CT-based solutions for real-world problems.

II.   The Role of Computational Thinking Course in Residential College Education

General education courses in computer science have been traditionally rooted in some combination of topics: computer hardware, computer programming, and computer application skills. In the past decades, most of courses were narrowly focused on teaching computer programming languages for science and engineering students, or teaching how to use computers as a user perspective. Computational Thinking, it represents a universally applicable attitude and skill set everyone not just computer scientists, would be eager to learn and use.[1] Computational Thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent.[2] CT includes a broad range of thinking tools and methods from computer science that empower students in all disciplines to more effectively solve problems, design systems and understand human behavior. CT can be used to algorithmically solve complicated problems and is used by major or non-major students.

The Residential College education in Yonsei University combines traditional learning with a wide range of activities to help freshman students develop the five capabilities (5C): Communication, Creativity, Convergence, Cultural diversity, and Christian leadership. The residential environment brings together students with different backgrounds and diverse cultures. Since creativity and problem solving ability are getting needed for everybody, we should broaden Computational Thinking to all of the freshman year students.

III.   Planning of Computational Thinking Course

As an integration of learning and living environment, Yonsei RC presents an excellent opportunity for students to interact and cooperate with residential colleagues. The multidisciplinary and diverse residential environment is one of the best places to set and experiment a new CT course.

Yonsei is offering the Holistic Education (HE) curriculum as a part of the RC education. Our CT course will be offered as a one-credit HE course. So, non-majors or the students with weak mathematical background, and even majors who just start to study computer science can take easily the CT course and get developed their capabilities. The CT course is designed to teach problem solving skills to freshman students majoring in any discipline who may be mathematically underprepared. Specifically, targeting RC freshmen, we develop fundamental CT practices including focal knowledge, skills, and abilities.

IV.   Course Introduction

Understanding how to express computing is essential for everyone who expects to live and work in a world where information is stored, accessed and manipulated. Such concepts are applicable and relevant for everyone and strongly recommended for those studying non-computer science majors. Computational Thinking Course focuses on introducing basic knowledge of computing along with logical reasoning and problem solving skills. Students will repeatedly practice how to self-define problems and find the corresponding solution and conceptualize it. Grafting computational knowledge with other disciplines will create a synergy effect and broaden the boundary of work that can be done by an individual.

V.   Course Designing

The CT course consists of four parts: what is CT & CT examples in daily life, Basic knowledge of computational concepts [3], applications in other disciplines [4], and term project for solving problems. We are not designing a lecture-oriented class, but encouraging a participation to solve problems based on class learning. This course includes to practicing problem solving in a team, and each student will have self-defining problem and solving experiences within a team.
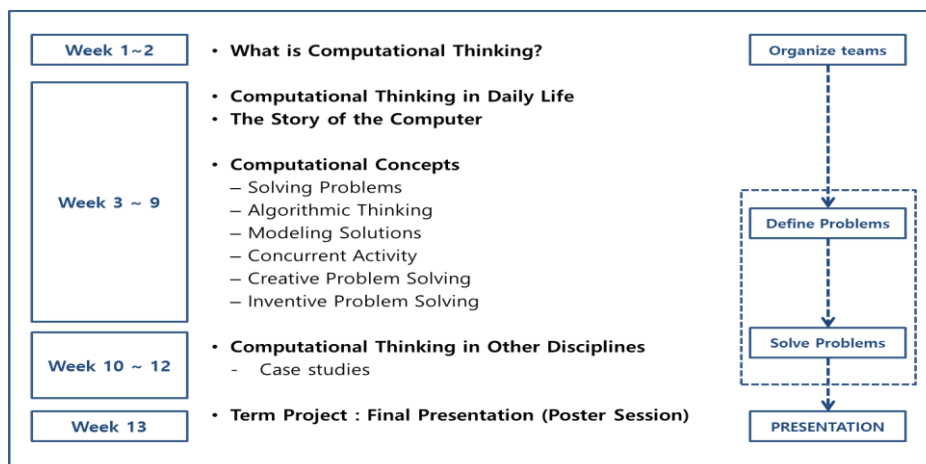
[Figure 1] Course Outlines

VI.   Further studies

This project is to develop a Computational Thinking course for freshmen-level students. In residential college education environment, we are focusing on empowering problem solving and critical thinking skills with creativity. This is a prototype course and further we are planning to expand the related and level-up classes in future.

References

[1] Jeannette M. Wing, "Computational Thinking", Communications of the ACM, vol.22, no.9, pp. 23-28, 2006.
[2] Jan Cuny, Larry Snyder, Jeannette M. Wing, "Demystifying CT for Non-Computer Scientists", Work in Progress, pp.246-249, 2010.
[3] David D. Riley and Kenny A Hunt, "Computational Thinking for Modern Problem Solver", Capman & Hall/CRC, 2014.
[4] Gadd, Karen, "TRIZ for Engineers: Enabling Inventive Problem Solving", Hoboken, NJ, USA: John Wiley & Sons, 2011.