JAIST STEAM SYMPOSIUM

International Symposium on STEAM Learning

THE PROCEEDINGS

STEAM 2019

April 20, 2019

Ishikawa Japan

Biography of Keynote Speakers

Biography of Prof. Coleen O' Connel Lesley University, USA

Coleen O'Connell has been the Director/Faculty of the Ecological Teaching and Learning MS Program at Lesley University, Cambridge, MA, USA since 1999. She just retired this past July but remains an Adjunct Faculty. Her scholarly interests have been to explore the intersection of Ecology, Education and Community. Working with teachers from every discipline, she challenged and guided educators to work across those disciplines. The collaboration with other teachers brought about transdisciplinary learning for their students allowing for real world problem solving and greater learning and engagement with their students. Lesley University, with its expertise in Education and the Arts was a leader in promoting the concept of STEAM (Science, Technology Engineering, Art and Math). Expressive Arts (Music, Drama, Poetry, Visual Arts, Design) are a natural pedagogical foundation for building understanding and assessing knowledge and skills. And they bring learning to life, and life to learning.

Coleen's lecture "The Evolution of Transdisciplinary Education: Why We Need STEAM Education" is a summary of her 36-year career as an educator. After an overview of the evolution, she will make the case for why we need Transdisciplinary and STEAM education for solving the world's pressing problems.

Biography of Prof. Sung-Won Kim (Ewha Woman's University, Korea)

STEAM Education in Korea

He graduated the Seoul National University and got PhD at KAIST (Korea Advanced Institute of Science and Technology) in 1983. He has been a Professor of Science Education Department at Ewha Woman's University since 1985. He was a visiting scholar at Caltech in US, ICRANET in Italy, and Yukawa Institute in Japan. He was the President of KOSSS (Korea School Science Society) and the Chairperson of KPhO (Korean Physics Olympiad Committee).

He is interested in the research on theoretical physics and science education, especially 'science imagination' and 'STEAM Education'. He developed the STEAM education model and various examples supported by KOFAC, Seoul Metropolitan Office of Education, and Gyeonggido Office of Education. Now he is also involved in the management of the STEAM R&E supporting program.

Biography of Prof. Yukari Nagai, Human Life Design Area

School of Knowledge Science, JAIST

Professor Yukari Nagai is in-charge of the Design Thinking Lab under Human Life Design Area, JAIST. She is supervising many Ph.D. students on diverse research interests. Moreover, she engages with many international organizations i.e. Member of the Design Society, ACM, ASME, Cognitive Science Society. Fellow of Design Research Society (FDRS). Editorial board member of Journal of Engineering Design (JED), Guest editor of Special Issue on Design Method and Design Research Methodology, Artifact, Routledge (2008) and Special Issue on Design Creativity, Journal of Engineering Design (JED) (2011), Editor-in-Chief of International Journal of Design Creativity and Innovation. Active in ACM International Conference Series on Creativity and Cognition (C&C) as a program co-chair (2011) and conference co-chair (2013). Visiting professor at Dalian Polytech University (2016-), Chair of Advisory Board of the Design Society (2017-), Associate member of Science Council of Japan (2017-).

Biography of Associate. Prof. Kim Eunyoung, Human Life Design Area School of Knowledge Science, JAIST

Dr. Eunyoung Kim is an associate professor of the school of knowledge science, Japan Advanced Institute of Science and Technology. After she graduated her Ph.D. from Department of Civil Eng., The University of Tokyo, she worked as a researcher at the Center for Knowledge Structuring, the University of Tokyo, Japan and had been running an innovative education program. Author has conducted interdisciplinary research with several renowned scholars in Korea, USA, Germany, and Japan. She published several papers on innovation studies, knowledge management, and education. Her specialty is designing an educational process for promoting innovations in diverse areas.

Abstracts of Keynote Speakers

Yukari Nagai, Kumi Yabuuchi

Learning Creativity by Art-Science-Technology

Japan Advanced Institute of Science and Technology, Japan

E-mail: ynagai@jaist.ac.jp

Abstract

Creativity is characteristic competency of human. However, it is uncertain how to foster creativity of individuals, except teaching creative techniques. This presentation gives a claim of human creativity that might be understood as learning rather than educating. Indeed, it is rare to address STEAM to gain innovative ability of human in higher education in comparison of children's education in pedagogy. Besides, this gap originated from disconnection of education scheme from early ages to adults and it would make an unbalance between the work in real world and in individual learning process.

In this presentation, we propose a reforming system to integrate multiple disciplines into creative knowledge. A plan of WISE (Doctoral Program for World-leading Innovative & Smart Education) program to be establish between Kanazawa College of Art (KANABI) and JAIST is shown and explained what projects are prepared to generate Art-Science-Technology. Introducing entertainment science, this project focuses on highlighting the value creation process of research with social implementation. We aim to foster creative competencies by integration of different knowledge and skills in cross diversity situation through learning by STEAM with advanced design thinking. A goal of this proposed program for reforming doctoral education is growing up the university students not only to be successful creators as human resources, but also to be challengers to lead social innovation to bring future society to reach SDGs, and to enhance motivations of human creativity.

Keywords: Creativity, STEAM in Doctoral Education, Social innovation and SDGs

Fabien Briffod, and Eunyoung Kim

Engineering in STEAM Education: A Case Study of French Engineering School

The University of Tokyo, Japan, and JAIST
E-mail: kim@jaist.ac.jp

Abstract

The educators in higher education are facing several challenges due to diverse changes in the social systems that support the institutions. In this regards, numbers of higher education institutes have launched educational program including STEAM education to foster the creative leaders of our future.

Especially, engineering education is differentiated from others because it is taught only in higher education. Thus, this study is to review the engineering education programs in the perspective of STEAM learning and its similar programs in higher education, introduce the content of program, and propose the future direction for STEAM education.

We reviewed the engineering education program in Western countries which had lead the series of industrial revolution to understand the pedagogical philosophy for developing the general curriculum. And we will introduce the STEAM education in today's French Grandes Ecoles and comparative case study of CDIO and Japanese graduate schools.

To conclude, we give recommendations for faculty, researcher in engineering education field, and student for promoting STEAM learning.

Keywords: engineering education, STEAM education, French Grandes Ecole education

Jung Yeop Lee, Ji Young Woo

The effects of gamification-based teaching math in higher education on student achievement and attitudes

Soonchunhyang University, Republic of Korea
E-Mail: elises@sch.ac.kr, jywoo@sch.ac.kr

Abstract

Media Labs College in Soonchunhyang University opened a compulsory course on mathematics education in 2018 entitled "Delicious Mathematics". This course teaches mathematical principles embedded in various games such as Catan, RumiCube, Pokemon Go, and Mafia games to first-year students of humanities. The students in this school are middle-class students who show the top 25-30% of the Korean SAT scores, and they are students who entered the humanities department because of fear of mathematics. Students must take courses in games, VR, robots, health care, etc., with multiple majors. At this time, basic math knowledge is required for students in the convergence major.

Delicious mathematics used pedagogy to enhance students' interest and engagement by using gamification techniques such as badges, progress, leaderboards, and missions. The presentation introduces the methodology of these different types of gamification, and introduces students to their effectiveness analysis through surveys and comparison of pre- and post-tests.

Keywords Mathematics Education, Gamification, Game-based Learning, Higher Education, Student Achievement and Attitudes

Aki Yamada

The need for STEAM in Society 5.0, an era of societal and technological fusion

Tamagawa University, Liberal Arts Program, Japan

E-mail: akiyamada124@lba.tamagawa.ac.jp

Abstract

In today's information driven society, technological advances in computing, communications, information handling, etc. have become strongly integrated into our everyday lives, to the point where it would be extremely challenging to imagine our modern lifestyles otherwise. The Japanese government envisions the next societal revolution as Society 5.0, where advanced technologies and service platforms integrate with and empower individuals in a human-based society. This paper will examine "next generation competencies" needed to carry out this vision. Where Science, Technology, Engineering, and Mathematics (STEM) education has traditionally focused on technical skills and knowledge, this paper will look at the potential role and benefits of incorporating liberal arts education into these technical studies. This concept of integrating the liberal arts into STEM education is known as STEAM. In this regard, Japanese higher education is currently facing the challenges of overcoming an educational structure that is rigidly compartmentalized by discipline. The purpose of the study is to create a foundation for clarifying the role of interdisciplinary education in overcoming the vertical division of academic disciplines and restoring the "integrated nature" of scholarship. This study seeks to contribute to an understanding of how the humanities, social sciences, and arts can be used to enhance STEM education, and furthermore, how this STEAM approach to education is key to enabling the vision for Society 5.0.

Keywords:

Education, STEM, STEAM, Interdisciplinary, Society 5.0, next generation competencies, global skills

Sung-Won Kim

STEAM Education in Korea

Ewha Woman's University, Korea

Abstract

In this talk I will introduce the current status of STEAM Education in Korea including the national policies and supporting programs adaptable at school class. We also consider the various programs of KOFAC (Korea Foundation for Advancement of Science and Creativity) which is the main supporting institute in Korea. Here we consider the theory of STEAM Education based on scientific inquiry and functional elements of our brain. As the STEAM Education program, I introduce the more familiar model 'hands-on, minds-on and hearts-on' STEAM model and a couple of examples of the model.

Presentation Files

1. **Prof. Coleen'O Connell, Lesley University, USA**

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2. **Dr. Brifford, The University of Tokyo**

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3. **Prof. J. Lee, Sooncheonhyang University**

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Appendix

Agenda of Kick-off event

PROGRAM

Saturday, April 20, 2019

10:10 – 10:20 : Registration (checking presentation setting)

10:20 – 10:30 : Welcoming remarks, Prof. Yukari. Nagai, Vice President of JAIST.

10:30 – 12:10 : Keynote speech (40 min presentation + 10 min Q&A)

10:30 – 11:20 : Prof. Coleen O' Connell, Lesley University, USA
"The Evolution of Trans-disciplinary Education: Why We Need STEAM Education"

11:20 – 12:10 : Prof. S. Kim, Ewha Women' s University, Korea
"STEAM Education in Korea"

12:10 – 13:50 : Lunch break

13:50 – 16:50 : Panel session (20 min presentation + 10 min Q&A) Chaired by Prof. E. Kim, JAIST

STEAM Learning in higher education : Science, Technology, Engineering, Math, Art and Game

13:50 – 14:20 : Prof. Yukari. Nagai, JAIST
"Advanced STEAM learning for creating innovations"

14:20 – 14:50 : Dr. Briffod, The University of Tokyo and Prof. E. Kim, JAIST
"Engineering in STEAM Education: a case study of French Engineering Schools"

14:50 – 15:20 : Prof. J. Lee, Sooncheonhyang University
"The effects of gamification-based teaching math in higher education on student achievement and attitudes"

15:20 – 15:35 : Tea break

15:35 – 16:05 : Prof. A. Yamada, Tamagawa University
"The need for STEAM in Society 5.0, an era of societal and technological fusion"

16:05 – 16:35 : Prof. A. Shimogohri, Hakodate College of Technology
"A study on Evaluation of STEAM Learning" . (In Japanese)

16:35 – 16:50 : Break

16:50 – 17:20 : Discussion and closing remarks

17:20 – Networking and campus / lab visit (On request)