



# Towards a Collaborative Society through Creative Learning: Book of Abstracts

Toshinori Saito, Tetsuro Kakeshita

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IFIP

WORLD CONFERENCE  
ON COMPUTERS IN  
EDUCATION

20-24 August 2022 in Hiroshima, Japan

Towards a Collaborative Society through Creative Learning

# BOOK OF ABSTRACTS

A Hybrid Conference

<https://wcce2022.org/>

Edited by Toshinori Saito and Tetsuro Kakeshita





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# WELCOME NOTE



## Welcome message from the IFIP TC3 Chair



It is my great pleasure to welcome you to the International Federation for Information Processing (IFIP) Technical Committee 3 (TC3) World Conference on Computers in Education 2022 (WCCE 2022), to be held onsite in Hiroshima, Japan, 21<sup>st</sup> – 24<sup>th</sup> August 2022, but also virtually online. The national representative to IFIP TC3 initially introduced the idea for this conference, and I am delighted that we are, as a result, being kindly hosted by the Information Processing Society of Japanese, in the heart of Hiroshima for those on-site.

The conference theme, “Towards a Collaborative Society through Creative Learning”, reflects a long-standing commitment to both learning and technology that has concerned members of TC3 and its working groups within the IFIP. Many, many dedicated and committed individuals have made this conference possible, allowing us to continue to explore our interests and concerns about the futures of computing and education. The Local Organising Committee has been actively involved in preparing for this conference, meeting the challenges created by the ever-evolving circumstances faced during the past two years, working out solutions and managing all the necessary detail, keeping the website up-to-date, producing this very book of abstracts, making sure that all of us, whether on-site or off-site, can engage and share effectively and easily. The co-chairs of the conference have, through their willingness, patience and dedication, managed and handled the elements of the programme – the submissions of the many willing contributors, the submission reviews supported by the generosity of the panel of reviewers, the final abstracts for this publication, and putting the programme together. The International Programme Committee members have regularly contributed and supported, with ideas and advice, and academic outcomes of our work will be handled by the lead editor in taking the publication of selected papers forward beyond the period of the conference itself.

Whether you are an existing member of IFIP, a non-member researcher, policy maker, developer, teacher, or learner, I welcome you. Please come and join this conference, to share and discuss, to consider the current and the future, and to focus on how we can continue to progress for the benefit of all.

I know that Japan as a nation recognises innovation and learning as being so important for its future. I am sure that through our contact with this environment and with those who help to shape it, that this conference will allow innovation and learning to prosper – and will help to lead us towards an important and sustainable future.

**Prof Don Passey**  
**Chair, IFIP TC3**





# ORGANIZING AND INTERNATIONAL PROGRAM COMMITTEES

## International Program Committee (IPC)

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- Jaana Holvikivi, WG3.4 representative, Samtaim Oy, Finland
- Cathy Lewin, lead editor, Manchester Metropolitan University, UK
- Javier Osorio, WG3.7 representative, Universidad de las Palmas de Gran Canaria, Spain
- Don Passey, chair TC3, Lancaster University, UK
- Toshinori Saito, LOC representative, Seisa University, Japan (Vice Chair LOC)

## Local Organizing Committee (LOC)

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- SAITO Toshinori, Vice Chair of the LOC, Seisa University, Japan
- INAMI Masahiko, The University of Tokyo, Japan
- KASHIHARA Akihiro, The University of Electro-Communications, Japan
- KUMAHIRA Mika, Showa Woman's University, Japan
- MIMA Noyuri, Future University Hakodate, Japan
- MURAI Jun, Keio University, Japan
- OIWA Hajime, ex.Keio University, Japan
- SUZUKI Kan, The University of Tokyo/Keio University, Japan
- TAKAHASHI Naoko, Kokugakuin University, Japan
- TAKEUCHI Ikuo, ex.The University of Tokyo, Japan
- UEMATSU Eriko, Musashino Gakuin University, Japan

# ORGANIZING AND INTERNATIONAL PROGRAM COMMITTEES

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- NAKAYAMA Yasuichi, The University of Electro-Communications, Japan
- NISHIDA Tomohiro, Osaka Gakuin University, Japan
- SHIMADA Atsushi, Kyushu University, Japan
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- TANI Seiichi, Nihon University, Japan
- TATSUMI Takeo, The Open University of Japan, Japan
- TOHYAMA Sayaka, Shizuoka University, Japan
- URANISHI Yuki, Osaka University, Japan
- WATANABE Hiroyoshi, Teikyo University, Japan
- YANAKA Hitomi, Tokyo University, Japan

## International Conference Center, Hiroshima (ICCH)

All conference sessions for the IFIP WCCE 2022 conference will be held at the International Conference Center Hiroshima (ICCH). ICCH stands in Hiroshima's sacred Peace Memorial Park. Completed in July 1989, ICCH is a commemorative facility built, in part, to celebrate the centennial of Hiroshima's official designation as a city.

ICCH includes Phoenix Hall, which seats 1,504, the Himawari Conference Hall (from 300 up to 800 seats), and other large, medium and small conference rooms, with lighting, sound, and simultaneous interpretation equipment. All are available for concerts, lectures, conferences, and other events that bring people together.



Address: 1-5, Nakajima-cho, Naka-ku, Hiroshima, Japan

Tel. 082-242-7777

Open from 9:00 to 21:00 JST

<https://www.pcf.city.hiroshima.jp/icch/english.html>

## Why Hiroshima?

Hiroshima has two UNESCO World Heritage Sites: the Hiroshima Peace Memorial (Genbaku Dome) and the Itsukushima Shinto Shrine.

# LOCATION GUIDE



## World Peace

The Hiroshima Peace Memorial (Genbaku Dome) was the only structure left in the area where the first atomic bomb exploded on 6 August 1945. It also expresses the hope for world peace and the ultimate elimination of all nuclear weapons.

## Scenic Beauty

Itsukushima Shinto Shrine consists of magnificent floating buildings. It plays on the contrasts of color and form between mountains and the sea. It is one of the Three Views of Japan and is also a Special Historic Site.

## Manufacturing Technology

Hiroshima is also known as a hub for manufacturing technology. Hiroshima has peacefully developed from the ashes of devastation, with achievements in research by Hiroshima University, the Japan Fisheries Research and Education Agency, and others, as well as global success achieved through corporations in the automotive, machinery, chemical, and other industries.

## Change Learning by Digital

Hiroshima has an education motto as follows: 'Pupils or students take pride in studying in Hiroshima. Be proud and talk about "Hiroshima" and "Japan." Work with people all over the world with high aspirations and create new value or innovation.' They use digital equipment to attain their goals.

## Easy to approach

Hiroshima is easy to access from the primary international airport. It takes one hour to go from Fukuoka to Hiroshima by Shinkansen. If you go from Osaka Kansai Airport, It takes two hours by Express and Shinkansen.

## Access to Hiroshima

### Access to Hiroshima by Air

There are two daily flights from Narita International Airport to Hiroshima Airport and 16 flights from Tokyo International Airport to Hiroshima Airport.

There are more than 10 buses daily from Hiroshima Airport to the Hiroshima Bus Centre. Please take the limousine bus bound for Hiroshima Bus Center from the 1st floor of the arrival gate, and get off at the Hiroshima Bus Center.

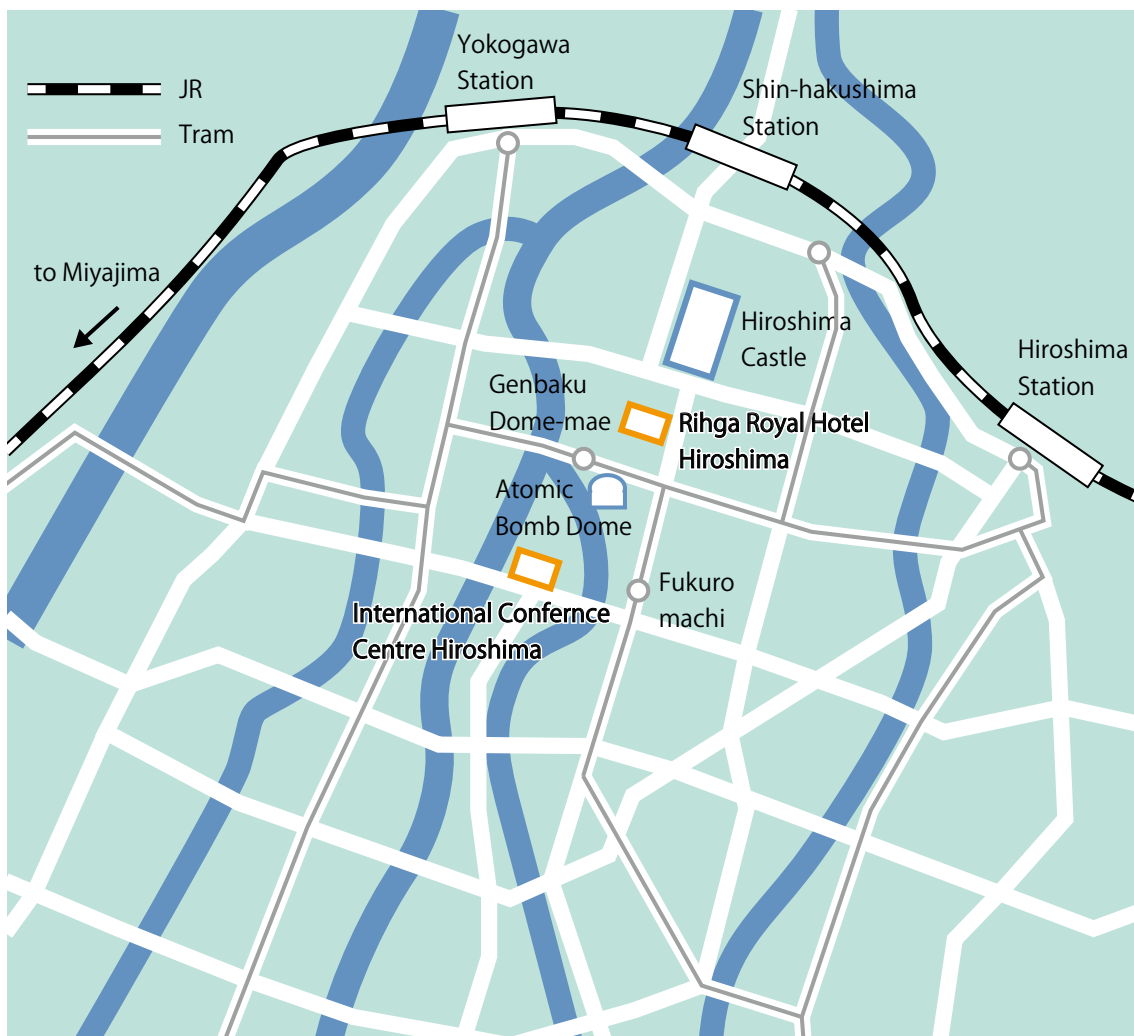


The local venue is the International Conference Centre Hiroshima (ICCH), located in Hiroshima's sacred Peace Memorial Park, about 15 minutes on foot from the Hiroshima Bus Centre.

## Access to Hiroshima by Train

The Shinkansen is a convenient way to reach Hiroshima from major Japanese cities such as Tokyo, Nagoya, Osaka, Kyoto, and Fukuoka. Take a tram bound for Eba or Miyajima from Hiroshima Station, and get off at "Genbaku Dome Mae." ICCH is a 10-minute walk from there.

## Hiroshima City Map







## Possibilities of CoCreative STEAM Ecosystem in the 21st Century, to Democratize



**Sachiko Nakajima**

**Date and Time:** Sunday, August 21, 10:00-11:00 JST

**Location:** Dahlia and Live Streaming (via Howspace)

Presentation Video will be provided via Howspace after the talk.

### Abstract

During the pandemic, we have been suffering from lots of anxiety and inconvenience due to lack of the “in-person meetings”. However, ironically, that also brought out the huge possibilities of “remote live communications” over various boundaries of countries, places, ages and sectors.

At our company steAm, Inc., we have been constructing the co-creative network “(Future) Earth School”, and connected various diversified points on the Earth. There, under the belief that “Everyone has the superb diversified creativity inside”, we have been trying to share various “instruments” like computational media, physical computing, AI, XR, math x design, regional value creations ... and found that we could deliver the joy of creations and various computational skills over online conference systems, also with videos, worksheets, mentorings and ecosystem. Computational thinking, which can draw out your creativity together with physical senses and liberal arts, can be grown through ICT.

In this talk, I would introduce various cases at schools and what not. For example, people in Cambodia who had never learned any coding, got really passionate in creating the cultural digital arts through online sessions with Japan. Like this, I would like to present cases which show the dramatic potentials of growing computational thinking through ICT and co-creative network on the Earth. Also, I would talk about how to grow mentors on computational skills to construct the social STEAM ecosystem, and some of our experimental “future” live performance with coding. During the session, I also would like to get various real-time ideas and questions on these so that we ourselves can co-create the playful STEAM “scene” of today there.

## Sachiko Nakajima - short bio

Born in Osaka, in 1979. Thematic Project Producer for World Expo, Osaka, Kansai, Japan 2025. Gold Medalist at International Mathematical Olympiad (unique female in Japan as of now). While majoring in mathematics (number theory) at University of Tokyo, she encountered with jazz and rock, and she started her music professional career after graduation. Now, she is working actively on 3 main field: Music, Mathematics, and STEAM Education. She has been designated as one of the STEM Girls Ambassadors in Japan by Japanese Cabinet Office and a member of “Learning Innovation” Study Group by Ministry of Economy, Trade and Industries in Japan. She also explored the intersection of art(s) and technology in NY, at ITP (Interactive Telecommunications Program), Tisch School of the Arts, New York University. As for educational activities, she also develops and provides SURIJOSHI (math-loving girls) workshops, Playful Coding/Playful Physical Computing/Playful AI, Sports x STEAM, Agriculture x STEAM, STEAM PBL/Exploration Support, Music x Math performance, talks and articles all over Japan (and in the world).





## Creativity, Computing Power, and Children's Future in Civil Society of the 21st Century (tentative)



**Taiwanese Digital Minister Audrey Tang**

**Date and Time:** Monday, August 22, 10:00-11:00 JST

**Location:** Dahlia and Live Streaming (via Howspace)

Presentation Video will be provided via Howspace after the talk.

### Abstract

Keynote speaker Audrey Tang, Taiwan's Minister of Digital Affairs, has worked to promote access to digital services for citizens. She also has advocated for the open data and open government to create an environment that allows citizens to benefit more from free data use. In this keynote, she will address the following question: how can we contribute to the emergent linkage between creativity, computing power, and the future of children in the civil society of the 21st century? Her wisdom shown in this address is based on her vision as a critical person in Taiwan's digital development and her belief as a promoter of education to liberate children's creativity as its central principle. In addition, the findings of this keynote will necessarily be the essence for us to solve the key issue of WCCE 2022: "Toward a Collaborative Society through Creative Learning."

### Audrey Tang - short bio

Audrey Tang is a Taiwanese free software programmer and Digital Minister of Taiwan. As a free software programmer, she is a community leader of Perl and Haskell and actively contributes to g0v ("gov zero"). This community takes the initiative in creating tools for the citizens of Taiwan's civil society. She also served on Taiwan's National Development Council's Open data committee and K-12 curriculum committee and acted as a leader of Taiwan's first e-Rulemaking project. She has been described as one of the "ten greatest Taiwanese computing personalities."

## Computing for All – Some Thoughts on the What, Why and How



**Professor Dr. Michael Kölling**

**Date and Time:** Tuesday, August 23, 14:00-15:30 JST

**Location:** Dahlia and Live Streaming (via Howspace)

Presentation Video will be provided via Howspace after the talk.

### Abstract

Mastery of skills of working with computers and knowledge of computing concepts have become an essential part of a modern education. A well-educated learner, in a modern society, should have foundational knowledge of the digital world, just as knowledge of foundations of the physical world – taught in Physics and Chemistry classes – has been considered part of a well-rounded education for many decades.

Most educators and education bodies agree on this goal; the details, however, are still unclear. What exactly are the concepts that should be taught? How deep, how technical, does the education need to be? How should we approach teaching these topics? What are the experiences that we should create for our students? What tools should we use?

In this talk, I will present my thoughts on these questions and discuss some possible answers. We should be prepared, however, for the possibility to end up with more questions than we started out with.

### Michael Kölling - short bio

Michael Kölling is the Vice Dean (Education) in the Faculty of Natural & Mathematical Sciences and a Professor of Computer Science at King's College London, UK. He holds a PhD in computer science from Sydney University, and has worked in Australia, Denmark and the UK. Michael's research interests are in the areas of object-oriented systems, programming languages, software tools, computing education and HCI. He has published numerous papers on object-orientation and computing education topics and is the author and co-author of two Java programming textbooks. Michael is the lead developer of BlueJ and Greenfoot, two educational programming environments. He is a UK National Teaching Fellow, Fellow of the UK Higher Education Academy, Oracle Java Champion, and a Distinguished Educator of the ACM. In 2013, he received the ACM SIGCSE Award for Outstanding Contribution to Computer Science Education. Michael is a founding member of 'Computing At School', a UK organisation furthering computing teaching at school level.





## Data and Evidence - Informed Education and Learning in Post Covid-19



**Professor Hiroaki Ogata**

**Date and Time:** Wednesday, August 24, 9:00-10:30 JST

**Location:** Dahlia and Live Streaming (via Howspace)

Presentation Video will be provided via Howspace after the talk.

### Abstract

We all experienced and witnessed some big changes in education during Covid-19 since January 2020. This talk will summarize what we learned from the emergency remote teaching during Covid-19 and what we should take out from our experiences for the next new normal in a post Covid-19 Era. In Particular, I will explain how it is very important to capture and analyze the teaching and learning process data, and to find and share the evidences in the nation-wide for a Post Covid-19 Era. Also, it is crucial to foster the self-direction skills of students by using their own learning data for the next new normal era.

### Hiroaki Ogata - short bio

Hiroaki Ogata is a Professor at the Academic Center for Computing and Media Studies, and the Graduate School of Informatics, Kyoto University, Japan. His current research focuses on Educational Data Science and Learning Analytics. He has published more than 500 peer-reviewed papers including SSCI Journals, international conferences and book chapters. He received several Best Paper Awards and gave keynote lectures in several countries. He is an editorial board member of IEEE TLT, IJCSCL, IJAIED, JLA, RPTEL, SLE, etc.



Date and Time: Sunday, August 21, 13:00-14:00 JST

Location: Dahlia and Live Streaming (via Howspace)

## Digital Literacy Activities at a Japanese Cyber Security Company

LAC Co., Ltd.  
cgj-info@lac.co.jp

**Abstract.** LAC Co., Ltd. is a leading company in security safeguards which provide cyber security service and system integration in Tokyo, Japan.

For the future business cultivation and security aware safety for ICT users, LAC supports a lot of nationwide schools from elementary to high school, collage, university, etc. as a research study.

How can we learn to utilize ICT effectively and how can we develop young generations to lead Japanese society in the future?

We will introduce followings our study outcomes that we are using actual research activities.

1. "Cyber Security Job File vol.1"

A professional referral guide to get children interested in cybersecurity.

2. "The Compass for Information Literacy Enlightenment"

This series of guidebooks, that compiles our study essence, can be used commonly in awareness-raising activities and utilizes them in teaching class in Japan.

3. "The LAC Radio"

An online radio program that introduces listeners with information on the activities of teachers who are dedicated to the education utilizing ICT in class.

Please feel free to join us!

**Keywords:** Cybersecurity, ICT, Information Literacy.

Date and Time: Monday, August 22, 13:00-14:00 JST

Location: Dahlia and Live Streaming (via Howspace)

## Issues and Practices in Information Education in School Settings

### As Seen Through Using an ICT Proficiency Assessment and Teaching Materials

Nawoko Sugasaki and Kazuki Miya

Benesse Corporation

Shinjyuku Mitsui Bldg., 2-1-1, Nishi Shinjuku, Shinjuku-ku, Tokyo 163-0413, Japan

<https://www.benesse-hd.co.jp/en/>

<https://www.p-pras.com/>

#### Abstract

As society and lifestyles continue to undergo profound changes driven by the spread of AI and internet connectivity to all kinds of things, Japan has been promoting information education, including programming, in all elementary, junior high, and high schools in phases starting in 2020.

Benesse Corporation provides educational materials and services based on feedback from the classroom to deliver quality information education to all children with a focus on supporting schools and teachers. In this session, centered on issues and practice in schools, we will introduce P-Study, an online digital teaching material that supports information education, and P-Plus, a CBT-type assessment test.

AIの普及、あらゆるものへのインターネット接続など、社会や生活は大きく変わりつつある中、日本では、2020年から段階的に、すべての小学校、中学校、高校でプログラミングをはじめとする情報教育を進めています。

ベネッセコーポレーションでは、学校や先生の支援を中心に、すべての子どもたちに良質な情報教育が届けられるよう、現場の声を活かした教材・サービスを提供しています。本セッションでは、学校現場の課題と実践を中心に、情報教育を支援するオンライン型デジタル教材PスタディとCBT型のアセスメントテストPプラスをご紹介します。

**Keywords:** ICT Proficiency Assessment, Teaching materials, computing, data science, Information design, Information ethics, K-12

Date and Time: Wednesday, August 24, 13:00-14:00 JST

Location: Dahlia and Live Streaming (via Howspace)

## **DX of learning materials in Japan; Development of basic skills and abilities through automatic scoring and establishment of learning habits**

Taichi Oda , Hiroshi Ota , Shiho Noichi

Fujitsu Japan Limited, Educational Solution Business Division

fjj-bunkyo-promotion@cs.jp.fujitsu.com

**Abstract.** Under the GIGA<sup>1</sup> School concept promoted by the Ministry of Education, Culture, Sports, Science and Technology in 2019, each student has a tablet and a network environment.

As a result, the use of digital technology in Japanese education is rapidly expanding.

In this presentation, we will focus on realizing personalized learning, which is the subject of the GIGA School Initiative.

This section introduces an outline and practical example of a digital teaching material service using automatic scoring function based on handwritten character recognition technology developed by Fujitsu Japan Limited to promote further DX.

We focused on developed learning materials that support basic learning and repetitive practice, which are used daily in Japanese schools like "kanji", "calculation", etc.

This system automatically recognizes the stroke order (the order in which characters are written) unique to kanji, scores them, and stores thought processes written in the margins of learning materials as learning histories.

Toward the realization of the integration of personalized learning and collaborative learning that Japanese education aims for, learning using these materials will be incorporated into daily educational activities and will greatly contribute to the development of basic skills and abilities that form the basis of these activities.

<sup>1</sup> GIGA : Global and Innovation Gateway for All

**Keywords:** automatic scoring, personalized learning, learning habit



# PLENARY AND SPECIAL SESSIONS

Date and Time: Sunday, August 21, 14:00-16:00 JST  
Location: Dahlia and Live Streaming (via Howspace)

## A panel session on Japanese education policy about ICTs and Society 5.0

Toshinori Saito<sup>1</sup>, Kosei Abiko<sup>2</sup>, Daisuke Asano<sup>3</sup>, Rie Hirakawa<sup>4</sup>, Mika Kumahira<sup>5</sup>, Hiroshi Suzuki<sup>6</sup> and Don Passey<sup>7</sup>

<sup>1</sup> Seisa University, Nihon-Oodori 11, Naka-ku, Yokohama, Kanagawa, Japan  
t-saito@gred.seisa.ac.jp

<sup>2</sup> Ministry of Education, Culture, Sports, Science and Technology, 3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo, Japan

<sup>3</sup> Ministry of Economy, Trade, and Industry, 1-3-1 Kasumigaseki, Chiyoda-ku, Tokyo, Japan

<sup>4</sup> Organization of Prefectural Board of Education in Hiroshima, 9-42, Motomachi, Naka-ku, Hiroshima, Hiroshima, Japan

<sup>5</sup> Showa Women's University Career College, 1-7-57 Taishidou, Setagaya-ku, Tokyo, Japan

<sup>6</sup> The University of Tokyo / Keio University, 7-3-1 Hongo, Bunkyo-ku, Tokyo Japan / 5322 Endo, Fujisawa, Kanagawa, Japan

<sup>7</sup> Department of Educational Research Lancaster University, LA1 4YD, United Kingdom

**Abstract.** This panel session is to share the voices from policy sides regarding Japanese education's challenges to create new education norms suitable for "Society 5.0" utilizing the potential of digital technologies. The vision for "Society 5.0" is defined as a desirable future society that comes after "Information Society (Society 4.0)" by the Japanese government. Japanese policymakers in charge of education have begun their challenges to reform Japanese education traditions, lagging behind digital technology use and maintaining old-fashioned education norms. This challenge is still ongoing under the collaboration of several different organizations, which is a new challenge for the Japanese policy sides. This panel session attempts to share such policymakers' voices and creates a new vision for the global educational challenges. For this purpose, we shall invite some influential Japanese policymakers and the experts concerned with Japanese educational reform together with the chair of IFIP TC3 and exchange their ideas about education's innovation for the coming new society.

**Keywords:** Society 5.0, GIGA School Program, Learning Innovation.

# PLENARY AND SPECIAL SESSIONS

Date and Time: Monday, August 22, 11:30-13:00 JST

Location: Dahlia and Live Streaming (via Howspace)

## Open Science for a Collaborative Society

Achmad Basuki<sup>1</sup>, Ai Sugiura<sup>2</sup>, Alwin Melkie Sambul<sup>3</sup>, Cher Ping Lim<sup>4</sup>, Eliko Akashi<sup>5</sup>, Fitrie Atviana Nurritasari<sup>2</sup>, Goki Miyakita<sup>6</sup>, Keiko Okawa<sup>7,8</sup>, Kiyoko Itagaki<sup>5</sup>, Khaing Khaing Wai<sup>9</sup>, Khin Mar Soe<sup>9</sup>, Muhammad Niswar<sup>10</sup>, Nasuha Lee Abdullah<sup>11</sup>, Noorsaadah A. Rahman<sup>12</sup>, Marcos Sadao Maekawa<sup>13</sup>, Rahmad Dawood<sup>14</sup>, Seck Lynn Nyi<sup>15</sup>, Yung-Wey Chong<sup>16</sup>

<sup>1</sup> Universitas Brawijaya, Department of Informatics Engineering

<sup>2</sup> Science Policy Capacity Building, the United Nations Educational, Scientific and Cultural Organization (UNESCO) Regional Science Bureau for Asia and the Pacific, Office Jakarta

<sup>3</sup> Sam Ratulangi University ICT Support Unit

<sup>4</sup> The Education University of Hong Kong Curriculum and Instruction

<sup>5</sup> Keio University Global Research Institute

<sup>6</sup> Keio Museum Commons

<sup>7</sup> Director of School on the Internet (SOI) Asia

<sup>8</sup> Keio University Graduate School of Media Design

<sup>9</sup> University of Computer Studies, Yangon, Faculty of Computer Science

<sup>10</sup> Universitas Hasanuddin Informatics

<sup>11</sup> Universiti Sains Malaysia, School of Computer Sciences

<sup>12</sup> University of Malaya, Institute for Advanced Studies

<sup>13</sup> APNIC Foundation

<sup>14</sup> Universitas Syiah Kuala, Computer Engineering

<sup>15</sup> 3XVIVR Production Golden Elephants Dragons Company Limited

<sup>16</sup> Universiti Sains Malaysia National Advanced IPv6 Centre

**Abstract.** Under the Internet society, the volume and way of people's communication has transformed significantly. Especially in science, the Internet enables researchers to collaborate on their research on a global scale, which accelerates research, mobilizes more stakeholders and strengthens the connection between science policy and society. At the 41st General Conference of UNESCO in November 2021, the first universal framework on Open Science was adopted by 193 countries as the UNESCO Recommendation on Open Science. The implementation of this framework would be a milestone for our society into a collaborative one. However, there are various challenges and issues that we need to think about for Open Science to ensure its fair and inclusive implementation. In this workshop, first, the culture, movement, and core values of Open Science will be shared by Dr. Ai Sugiura from UNESCO Jakarta. Then, four speakers who have been working in the fields of; ICT and culture, ICT and education, and ICT and science will share their experiences and challenges for realizing Open Science in their own fields. The discussion will be continued by a dialogue among the participants from different economies, positions, or roles, for anchoring Open Science movement beyond the traditional scientific community. Discussion topics will be divided into, culture, education and science. Participants will share their thoughts on the topics that are of particular interest and discuss the benefits, diverse paths, expectations, and foreseen challenges of the implementation of Open Science. Then, they will reflect on an action plan for fostering a culture of inclusive and fair Open Science with participants and facilitators. At the conclusion of this workshop, participants are expected to share a common understanding of Open Science and its benefits and challenges.

**Keywords:** Open Science, ICT, Asian Pacific



# PLENARY AND SPECIAL SESSIONS

Date and Time: Monday, August 22, 14:00-16:00 JST

Location: Dahlia and Live Streaming (via Howspace)

## JST Global Science Campus (GSC) Experts in Information Science Program

JST<sup>[1]</sup> with NII, IPSJ and JCIOI

<sup>1</sup> Japan Science and Technology Agency, <https://www.jst.go.jp/EN/>

**Abstract.** The Informatics Experts Program is a Global Science Campus (GSC) program supported by JST and administered by NII since FY 2019. The program aims to provide students in junior and senior high schools and technical colleges with world-class understanding of mathematics, algorithmics, programming, and software development skills through exposure to cutting-edge informatics research, and to provide them opportunities to conduct collaborative research with top-class Japanese researchers in the field of informatics. The program is currently in its third year, with its third cohort of students conducting their research.

In this poster presentation, first- and second-year students who conducted research through this program will present the results of their research.

1. Development of an app that connects teachers and students and solves questions  
Shintaro Morimoto (Koshi high school)
2. CurtainRail : A linear-structure based kinetic data structure for continuous spatial searching  
Teruki Tada (Future University Hakodate)
3. Time-leaping classroom experience for active learning  
Shutaro Aoyama (The University of Tokyo)
4. Flaming Analysis of Social Media with Transformer-based Model  
Fumiya Uchiyama (The University of Tokyo)
5. Right-to-left online construction of augmented position heaps  
Hiroki Shibata (University of Tsukuba)
6. Enumerating ordered trees with degree bounds by ZDD  
Kohei Ohno (National Institute of Technology, Tokyo College)
7. Improving the High School Course Allocation System using Market Design  
Mitsuka Kiyohara (Menlo School)
8. Coloring a Chessboard with a Generalized Knight  
Yuya Kobayashi (Fujishima High School)
9. Coa: Parallel-native Programming Language and Yarnkey: A Thigh-worn Wearable Input Device for 2D Alphabetic Patterns using Conductive-threads-based Touch Sensing  
Ken Shibata (William Lyon Mackenzie Collegiate Institute)
10. An automatic generation system of crochet charts for scrubbies  
Mayu Arino (Senri International School of Kwansei Gakuin)
11. Optimize saliency in specified region in images  
Mutsuha Asada (University of Tsukuba)
12. Nash equilibria in a biased rock-paper-scissors-urn game  
Mizuki Murayama (The University of Tokyo Secondary school)

Registered participants can access all technical sessions via Howspace.

## Sunday, August 21

### Opening ceremony

Time: 9:00-10:00, Room: Dahlia

### 1 : Keynote Speech: Ms. Sachiko Nakajima

Time: 10:00-11:00, Room: Dahlia

Possibilities of CoCreative STEAM Ecosystem in the 21st Century, to Democratize

### Coffee Break

Time: 11:00-11:30

### 2B : Workshop Session

Time: 11:30-13:00, Room: Cosmos-1

Practical Online Method of Situated Learning for Programming involving Interaction with a Computer

Riko Takanohashi, Naoya Yamanaka and Shinya Cho

### 2C : Learning with Digital Technologies in Higher Education

Time: 11:30-13:00, Room: Cosmos-2

How Mature is m-Learning in an Educational Institution?

Muasaad Alrasheedi and Luiz Fernando Capretz

Stress from COVID-19 Disaster and Awareness of Learning: A Case Study of Japanese University Students

Yutaro Ohashi

How ICT Tools Support a Course Centered on International Collaboration Classes

Shigenori Wakabayashi, Jun Iio, Kumaraguru Ramayah, Rie Komoto and Junji Sakurai

### 2D : Computing Education in Secondary and Higher Education

Time: 11:30-13:00, Room: Ran-1

A Proposal for Intermediate Content: Transition from Visual to Text-Based Languages

Katsuyuki Umezawa, Makoto Nakazawa and Shigeichi Hirasawa

Registered participants can access all technical sessions via Howspace.

Evaluation of a System for Generating Programming Problems Using Form Services  
Takumi Daimon and Kensuke Onishi

How to Quickly Acquire Basic Knowledge in Introductory Programming with PBL: Clarify  
the Relationship between Drawing Materials and Textbooks  
Natsuko Uchida and Yasushi Kuno

## **2E : Digital Education in Schools, Universities, and Other Educational Institutions**

Time: 11:30-13:00, Room: Ran-2

Information Design Education as Unplugged Computer Science Using School Library: Ex-  
ercises of Information Organization Based on LATCH  
Nagayoshi Nakazono

Educational Support to Develop Socially Disadvantaged Young People's Digital Skills and  
Competencies: An Exploration on Collaborative Relationship's Contribution toward Young  
People's Empowerment  
Toshinori Saito

Building Primary School Teachers "Technology" Capacity for STEM Programs  
Tanya Linden, Therese Keane, Anie Sharma and Andreea Molnar

## **2F : Poster Session: Learning with Digital Technologies**

Time: 11:30-13:00, Room: Conference room A

An Interactive 3D CG Visualization of Speech Organs for Speech Therapy Education using  
MetaHuman  
Tatsuro Kudo, Shiho Tajiri, Sachiyo Hasegawa, Yuri Fujiwara, Ichiro Yamamoto, Kar-  
en Kugishima and Kuriko Kudo

Practical Experiences of Using ICT for Online Architectural Design Classes Linking up  
Five Japanese Technical Colleges  
Daisei Yamano, Takeshi Kobayashi and Hideki Watanabe

ShadowingPlayerPlus: Pronunciation Learning Application with Automatic Feedback/Re-  
peat - Easy Pronunciation Exercise Method  
Hirokazu Tanaka and Naotaka Kato

Training of Central Vein Catheterization in Virtual Reality with Real-Time Cross Section  
Visualization of an Anatomical Model  
Satoki Shibata, Rukumo Higuchi, Ryota Yamamoto, Yudai Nagano and Haruka Muraka-

Registered participants can access all technical sessions via Howspace.

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Creating Effective Student Engagement in the Digital Learning Environment by using MOOCs and Gamification Concepts

Akihiro Nishikawa, Yui Kenjo, Momoko Nakamura, Chie Gondo and Makiko Oyama

Different Time Zones, Different Cultures and Active Learning: Teaching Software Engineering Online

Simona Vasilache

ParoTone : Development of a System to Build a Relationship between Imitating and Being Imitated by Instrumentalists through an Intuitive Interface

Dai Taniguchi, Shinjiro Mita, Kazuki Nakayama, Shunichi Sugimoto and Satoru Iwasaki

Evaluating Course Grading Fairness in Comparison of Learning Activity Logs Before and After COVID-19

Hiroyuki Kuromiya, Rwitajit Majumdar and Hiroaki Ogata

## **2G : Paper Session: Computing Education in Elementary and Primary Schools**

Time: 11:30-13:00, Room: Conference room B

Research on Enhancing Computational Thinking of Elementary School Student

Raoul Joseph Olinga Toh and Takaoka Eiko

Developing Gender-Neutral Programming Materials: A Case Study of Children in Lower Grades of Primary School

Sayaka Tohyama and Masayuki Yamada

Robotics in Primary Education: a Lexical Analysis of Teachers' Resources across Robots

Christophe Reffay, Gabriel Parriaux, Béatrice Drot-Delange and Mehdi Khaneboubi

## **Lunch Break**

Time: 13:00-14:00

## **3 : Sponsored Symposium: LAC**

Time: 13:00-14:00, Room: Dahlia

Digital Literacy Activities at a Japanese Cyber Security Company

## **4A : Plenary Session: Society 5.0**

Time: 14:00-16:00, Room: Dahlia

A Panel Session on Japanese Education Policy about ICTs and Society 5.0



# IFIP WCCE PROGRAMME

Registered participants can access all technical sessions via Howspace.

## **4F : Symposium Session**

Time: 14:00-16:00, Room: Conference room A

Educating All Teachers in Informatics: Necessities and Strategies

Torsten Brinda, Ludger Humbert, Matthias Kramer and Denise Schmitz

## **4G : Learning with Digital Technologies**

Time: 14:00-16:00, Room: Conference room B

Analysis of Facial Expressions for the Estimation of Concentration on Online Lectures

Renjun Miao, Haruka Kato, Yasuhiro Hatori, Yoshiyuki Sato and Satoshi Shioiri

Using a Cloud-based Video Platform for Pre-Service Teachers' Reflection

Tomohito Wada, Chikako Kakoi, Koji Hamada and Chikashi Unoki

Comparison of Teaching Environment in Hybrid-Flexible Class

Naru Miyake, Noboru Nakamichi and Kazuaki Yoshihara

Enhanced Online Academic Success and Self-Regulation through Learning Analytics Dashboards

Yassine Safsouf, Khalifa Mansouri and Franck Poirier

## **Coffee Break**

Time: 16:00-16:30

## **Poster Presentation Core Time**

Time: 16:00-16:30, Room: B1 Robby

## **5A : Symposium Session**

Time: 16:30-18:00, Room: Dahlia

Japanese Lessons on ICT in Education with GIGA School Program

Sayaka Tohyama

## **5B : Symposium Session**

Time: 16:30-18:00, Room: Cosmos-1

Features of Innovative use of Technology during the COVID-19 Period in India

Amina Charania, Durba Sarkar, Babita Majumder, Sohini Sen, Raoson Singh and Lina Adinolfi



Registered participants can access all technical sessions via Howspace.

## **5C : Informatics in Secondary and Higher Education**

Time: 16:30-18:00, Room: Cosmos-2

What Students Can Learn about Artificial Intelligence - Recommendations for K12 Computing Education

Tilman Michaeli, Ralf Romeike and Stefan Seegerer

How Do Students Learn in an Online Programming Course?

Keiichi Takahashi

Web Application Development Achievement: Clarifying the Relationship between Visual GUI Design and Textual Programming

Djordje Kadijevich

## **5E : National Session**

Time: 16:30-18:00, Room: Ran-2

Shedding Light on Shadow: Leveraging Global Open Source and Open Standard for K12 and Higher Education I

Shoji Kajita and Tsuneo Yamada

## **5F : Symposium Session**

Time: 16:30-18:00, Room: Conference room A

Educating All Teachers in Informatics: Necessities and Strategies (Symposium Session Part II)

Torsten Brinda, Ludger Humbert, Matthias Kramer and Denise Schmitz

Foundations of Computer Science in General Teacher Education – Findings and Experiences from a Blended-Learning Course

Stefan Seegerer, Tilman Michaeli and Ralf Romeike

## **5G : Panel Session**

Time: 16:30-18:00, Room: Conference room B

Informatics Reference Framework for School

Mary Webb and Don Passey

## **Welcome Reception**

Time: 18:15-19:45, Room: Dahlia

# IFIP WCCE PROGRAMME

Registered participants can access all technical sessions via Howspace.

## Monday, August 22

### 6 : Keynote Speech: H.E. Audrey Tang

Time: 10:00-11:00, Room: Dahlia

Creativity, Computing Power, and Children's Future in Civil Society of the 21st Century  
(tentative)

### Coffee Break

Time: 11:00-11:30

### Poster Presentation Core Time and Morning Break

Time: 11:00-11:30, Room: B1 Robby

### 7A : Special Session by SOI Asia

Time: 11:30-13:00, Room: Dahlia

Open Science for Collaborative Society

### 7B : National Session

Time: 11:30-13:00, Room: Cosmos-1

Shedding Light on Shadow: Leveraging Global Open Source and Open Standard for K-12  
and Higher Education II

Shoji Kajita and Tsuneo Yamada

### 7C : Learning with Digital Technologies in Higher Education

Time: 11:30-13:00, Room: Cosmos-2

Distance Learning in Sports: Collaborative Learning in Ice Hockey Acquisition Processes  
Masayuki Yamada, Yuta Ogai and Sayaka Tohyama

Digital Object-based Learning with Curated Resources in University Museums and Libraries during the COVID-19 Pandemic

Sayuri Tanabashi

Development Plan and Trial of Japanese Language e-Learning System Focusing on Content and Language Integrated Learning (CLIL) Suitable for Digital Education

Shizuka Nakamura and Katsumi Wasaki

An Easy-to-Use Screen Capturing Tool for Supporting in-Class CS Learning Activity

Registered participants can access all technical sessions via Howspace.

Hiroyuki Nagataki and Maiko Shimabuku

## **7D : Digital Education in Schools, Universities, and Other Educational Institutions**

Time: 11:30-13:00, Room: Ran-1

Trends of Checklist Survey of Computer Operational Skills for First-Year Students: Over the Past Four Years

Daisuke Kaneko, Yukiya Ishida, Masaki Omata, Masanobu Yoshikawa and Takaaki Koga

Response to Online Classes at Dokkyo University

Lumi Tatsuta, Ikumi Horie and Kai Li

An Analysis of Practical Example in Real-time Online Classes of Fundamental Course for the Universe in a Flipped Classroom Format Using Digital Diamond Mandala Matrix

Seiichiro Aoki, Shinzo Kobayashi, Toshihiko Naraki, Gary Hoichi Tsuchimochi and Toshio Okamoto

National Policies and Services for Digital Competence Advancement in Estonia

Mart Laanpere, Linda Helene Sillat, Piret Luik, Piret Lehist and Kerli Pozhogina

## **7E : Workshop Session**

Time: 11:30-13:00, Room: Ran-2

Non-English-based Programming

Keiji Emi and Akimasa Takenaka

## **7F : Computing Education in Higher Education**

Time: 11:30-13:00, Room: Conference room A

Evaluation of a Data Structure Viewer for Educational Practice

Kensuke Onishi

Development of Education Curriculum in the Data Science Area for a Liberal Arts University

Zhihua Zhang, Toshiyuki Yamamoto and Koji Nakajima

Improving Motivation in Undergraduate Data Science Education by Using Dilemma Problems

Yuko Murakami, Yukari Sho and Tomohiro Inagaki

## **Lunch Break**

Time: 13:00-14:00

# IFIP WCCE PROGRAMME

Registered participants can access all technical sessions via Howspace.

## **8 : Sponsored Symposium: Benesse Corp.**

Time: 13:00-14:00, Room: Dahlia

Issues and Practices in Information Education in School Settings: As Seen through Using an ICT Proficiency Assessment and Teaching Materials

## **9A : Special Session by National Institute of Informatics**

Time: 14:00-16:00, Room: Dahlia

JST Global Science Campus (GSC) Experts in Information Science Program  
A Poster Session for Nominated Secondary and High-school Students

## **9B : National Session**

Time: 14:00-16:00, Room: Cosmos-1

Digital Technologies in a STEM Curriculum  
Pieter Hogenbirk

## **9C : Learning with Digital Technologies in Secondary and Higher Education**

Time: 14:00-16:00, Room: Cosmos-2

LeaP- Quest in Madrasahs of West Bengal, India during COVID-19 Pandemic: Perspectives, Opportunities, and Challenges

Babita Dutta Majumder, Raoson Singh and Nikhat Nasrin

Digital Education in the Post-Covid Era: Challenges and Opportunities to Explore  
Kleopatra Nikolopoulou

Design and Performance of Video Interview in a MOOC  
Halvdan Haugsbakken

Users' Satisfaction and Effectiveness in Practice of e-learning: Midlands State University, Zimbabwe Case Study

Shepard Pondiwa, Nicholas Mavengere, Nyarai Chibanda, Festus Adedoyin, Angelos Stefanidis, Francis Manzira and Umayra Said El-Nabahany

Text-Mining Analysis of What Students Think about e-Learning and Face-to-Face Class on Account of COVID-19.

Minae Nishimoto and Keiji Emi

## **9D : Digital Education in Schools, Universities, and Other Educational Institutions**

Time: 14:00-16:00, Room: Ran-1



Registered participants can access all technical sessions via Howspace.

Development and Evaluation of a Field Environment Digest System for Agricultural Education

Kanu Shiga, Tsubasa Minematsu, Yuta Taniguchi, Fumiya Okubo, Atsushi Shimada and Rin-Ichiro Taniguchi

Developing Teaching and Learning Innovations; a Case Study of Indo-Finnish Collaboration

Mikko Ruohonen and Gururaj Mahajan

Where is Technology in the 'Golden Thread' of Teacher Professional Development?

Chris Shelton and Mike Lansley

Professional, Higher and Vocational Education in ICT: IFIP WG3.4 Working Conference Papers over the Years

Arthur Tatnall, Mikko Ruohonen and Barrie Thompson

## **9E : Symposium**

Time: 14:00-16:00, Room: Ran-2

Informatics in Primary Education: Approaches, Current Issues and Lessons Learnt (Symposium Session Part I)

Ivan Kalas, Torsten Brinda and Peter Micheuz

## **9F : Computing Education in Higher Education**

Time: 14:00-16:00, Room: Conference room A

Improvement of Fill-in-the-Blank Questions for Object-Oriented Programming Education

Miyuki Murata, Naoko Kato and Tetsuro Kakeshita

Automated Reporting of Code Quality Issues in Student Submissions

Oscar Karnalim, Simon, William Chivers and Billy Susanto Panca

Mitigating Accidental Code Plagiarism in a Programming Course through Code Referencing

Muftah Afrizal Pangestu, Simon and Oscar Karnalim

Coding Education for Adults Using Distance Learning in Japan

Takeo Tatsumi, Kumiko Aoki, Hiroaki Yuze and Takayuki Watanabe

Programming Education at Tokyo Online University

Joji Maeno, Katsuhiko Kakehi, Noriko Suzuki and Shinji Nakamura

## **9G : Poster Session: Learning with Digital Technologies**

Time: 14:00-16:00, Room: Conference room B

Registered participants can access all technical sessions via Howspace.

Hybrid Mode of Counseling for Student Startups – A Success Story of University of Agricultural Sciences Dharwad (UASD), India

Mahadev Chetti, Shrishail Dolli, Krishnaraju P U and Ashalatha K V

Prediction of Engagement from Temporal Changes in Facial Expression

Haruka Kato, Koki Takahashi, Yasuhiro Hatori, Yoshiyuki Sato and Satoshi Shioiri

A Practical Report of Online Class between Japan and the Philippines in COVID-19

Yasuyo Fukunaga, Natsuko Uchida and Cynthia Zayas

The Research for Supporting Gifted and Talented Pupils in Metaverse

Shun Ito, Shiori Murakami and Shunichi Sato

Rubric Self-Assessment System for Technical Standards

Makoto Miyazaki, Hiroyoshi Watanabe, Mieko Masaka and Kumiko Takai

e-Readiness of Teachers and Scientists of Farm Universities : A Case Study in India

Parvaty A and Shrishail Dolli

Detection of Synchronized Head Movements from a Single Classroom-Scene Video

Yasuhiro Hatori, Taira Nakajima and Shinichi Watabe

Proposal for a Flipped Classroom Model to Promote Autonomous Learning

Yasuomi Takano, Hiromu Kasahara, Keisuke Maekawa, Haruki Ueno, Hiroto Yamakawa and Hiroshi Komatsugawa

Problem-Solving University Educational Program Using Collaboration between Medicine and Design

Kuriko Kudo, Naoshige Akita, Hiroyuki Matsuguma, Shunta Tomimatsu, Shiho Tajiri, Nobuko Hashiguchi, Miho Hayata, Yasuyuki Hirai, Shuji Shimizu and Tomohiko Moriyama

Imagine, a Smartphone Costs ¥100,000,000...

Ben Tsutom Wada

## 10A : Workshop Session

Time: 16:00-17:30, Room: Dahlia

Computational Thinking in Teacher Education

Valentina Dagienė, Gerald Futschek, Yasemin Gulbahar, Martina Landman and Gabrielė Stupurienė

Registered participants can access all technical sessions via Howspace.

## **10B : Learning with Digital Technologies in Higher Education**

Time: 16:00-17:00, Room: Cosmos-1

EdTech as an Empowering Tool: Designing Digital Learning Environments to Extend the Action Space for Learning and Foster Digital Agency

Sadaqat Mulla and Nagarjuna G

Five Years of Experience in Improvement of a Technical English Class using Information Technologies

Takashi Yamanoue

Transnational Pedagogy and Global Teaching of Noh Theatre: Initial Reflection on Teaching Noh Theatre Online during the Pandemic (from Philippines to Canada)

Dennis Gupa and Amparo Umali

## **10C : Learning with Digital Technologies**

Time: 16:00-17:00, Room: Cosmos-2

Event Style Preferences in Medical Research Meetings in Japan

Shunta Tomimatsu, Shuji Shimizu, Kuriko Kudo, Toru Oga, Shintaro Ueda and Tomohiko Moriyama

Simulating Fieldwork “in Action” through Digital Technology among Ferris University Students

Cynthia Neri Zayas, Natsuko Uchida, Eri Ono and Erina Asano

## **10D : Digital Education in Schools, Universities, and Other Educational Institutions (Higher Education)**

Time: 16:00-17:00, Room: Ran-1

A Scoping Review on The State-of-art Educational Data Mining and Learning Analytics in Prediction of Students’ Learning Performance

Chunping Li, Mingxi Li, Chuan-Liang Huang, Yi-Tong Tseng, Soo-Hyung Kim and Soonja Yeom

Implementation and Evaluation of University Information Placement Test in Japan

Naohiro Chubachi, Tomohiro Inagaki and Kazuki Kawamura

Registered participants can access all technical sessions via Howspace.

## **10E : Symposium**

Time: 16:00-17:00, Room: Ran-2

Informatics in Primary Education: Approaches, Current Issues and Lessons Learnt (Symposium Session Part II)

Ivan Kalas, Torsten Brinda and Peter Micheuz

## **10F : Computing Education in Higher Education**

Time: 16:00-17:00, Room: Conference room A

Multiple Platform Problems in Online Teaching of Informatics in General Education Faced by Part-time Faculty Members

Hajime Kita, Naoko Takahashi and Naohiro Chubachi

The Tools which Assist “Creating Questions through Interaction with a Computer”

Shinya Cho, Naoya Yamanaka, Shigeki Kitajima and Takayuki Konno

Comparison of Academic Impacts of Online Classes in the Real-time Setting with the On-demand Viewing Model

Toru Ochi and Koji Tateno

## **10G : Poster Session: Computing Education**

Time: 16:00-17:00, Room: Conference room B

Visualizing Information Security Controls Using Virtual Reality Head-Mounted Displays

Chunming Gao and Noriyuki Iwane

Hands-on Training to Configure Communication Networks with GNS3 (Graphical Network Simulator - 3) Web Server for 40 Senior High School Students in a Class (Demonstration Included)

Naotaka Kato

Effective Case Studies of Supporting Class by Engineers in Company at Tokyo P-TECH

Tetsuo Fukuzaki, Kaori Namba, Tomoaki Mori and Yuji Kato

Analysis of Learning Patterns and Final Grades in an Online University and a Study of Appropriate Intervention Methods for Students

Yasuhisa Kato

Development of a Coding Skill Training System using “Clone Coding”



Registered participants can access all technical sessions via Howspace.

Hitoshi Sasaki and Junya Hamada

Using Machine Learning to Analyze Keystroke Dynamics for Programming Proficiency  
Shiho Takano, Miyu Tamura, Teruno Kajiura, Yuka Sato, Nanako Takizawa, Yuka Akinobu and Kimio Kuramitsu

Implementation and Teaching Plan of Spreadsheet Application for Basic Education of Artificial Intelligence  
Akihito Kitadai

The Cyberethics Grade Comformation System for Shibboleth Federated LMS  
Nobukuni Hamamoto, Koichi Ogawa, Hiroshi Ueda, Masako Furukawa, Motonori Nakamura and Kazutsuna Yamaji

An AI-based Chatbot for Programming Education on the Colaboratory  
Momoka Obara, Nao Souma, Miyu Sato, Mai Takahashi, Teruno Kajiura, Mayu Tomio-ka, Yuka Akinobu and Kimio Kuramitsu

## **11F : AGM 3.1**

Time: 17:00-18:00, Room: Conference room A

## **11G : AGM 3.4**

Time: 17:00-18:00, Room: Conference room B

## **Banquet at Rihga Royal Hotel Hiroshima**

Time: 18:30-21:00

## **Monday, August 23**

### **Morning Social Program 1 (Miyajima)**

Time: 09:00-13:00

### **Morning Social Program 2 (High Schools)**

Time: 09:00-13:00

### **Morning Social Program 3 (MAZDA Museum)**

Time: 08:30-13:00

### **Morning Social Program 4 (Walk-tour: Hiroshima Castle, Shukkeien Garden)**

Time: 09:00-13:00

# IFIP WCCE PROGRAMME

Registered participants can access all technical sessions via Howspace.

## **Lunch Break**

Time: 13:00-14:00

## **13 : Keynote Speech: Dr. Michael Koelling**

Time: 14:00-15:30, Room: Dahlia

Computing for All – Some Thoughts on the What, Why and How

## **Coffee Break**

Time: 15:30-16:00

## **14A : Workshop Session**

Time: 16:00-18:00, Room: Dahlia

Designing Digital Credentials for Validating IT Skills: A Case for i-Competency Dictionary --  
Keiko Tanaka, Masumi Hori and Keiji Emi

## **14B : Panel Session**

Time: 16:00-18:00, Room: Cosmos-1

Zanzibar Declaration Panel on 'Sustainable Education in a Digital Age of Rapidly Emerging Technologies' at the WCCE 2022  
Johannes Magenheim

## **14C : Digital education in Schools, Universities, and Other Educational Institutions**

Time: 16:00-18:00, Room: Cosmos-2

Universities of the Future and Industrial Revolution 4.0: The Academy Transformation  
Maria Teresa Pereira, Manuel S. Araújo, António Castro and Maria J. Teixeira

Instructional Methodologies for Lifelong Learning Applied to a Sage Pastel First-year Module  
Tania Prinsloo, Pariksha Singh and Komla Pillay

## **14D : Learning with Digital Technologies in Secondary and Primary Education**

Time: 16:00-18:00, Room: Ran-1

Indicators of Learning Enhancement Factors in Educational Mobile Apps used in Informal Settings  
Iiris Tuvi, Jussi Okkonen and Terje Våljetaga

Registered participants can access all technical sessions via Howspace.

Predictive Evaluation of Artificial Intelligence Functionalities of Software: a Study of Apps for Children's Learning of English Pronunciation

Mengqi Fang and Mary Webb

A Workshop of a Digital Kamishibai System for Children and Analysis of Children's Works

Masataka Murata, Keita Ushida, Yoshie Abe and Qiu Chen

Digital Technologies for Learning, Teaching and Assessment: Tackling the Perennial Problem of Policy and Practice

Deirdre Butler and Margaret Leahy

Proposal of Disaster Prevention Simulation Game using VR: Disaster Prevention Education from "Boring" to "Fun"

Saaya Kamiyo, Chie Nakagawa and Natsuko Uchida

## **14E : Computing Education in Higher Education**

Time: 16:00-18:00, Room: Ran-2

A Feasibility Study on Learning of Object-Oriented Programming based on Fairy Tales

Motoki Miura

AI Ethics with Emphasis on Philosophy and History of Science

Yuko Murakami

Gender-Inclusive Learning Materials for Programming Focused on Data Visualization

Takehisa Mashimo, Taeko Ariga and Tomoko Yoshida

Curriculum Standard of Informatics in General Education at Universities in Japan

Tomohiro Inagaki, Naoko Takahashi and Michio Nakanishi

Changes in Attitude towards Mobile App Development: a Preliminary Comparison between MIT App Inventor and Android Studio

Zilu Liang

## **14F : Computing Education in Secondary Schools**

Time: 16:00-18:00, Room: Conference room A

Generalization in Programming Classes

Michael Weigend

The Impact of Tolerance for Ambiguity on Algorithmic Problem Solving in Computer Science

Registered participants can access all technical sessions via Howspace.

## Lessons

Lisa Schütte, Matthias Matzner and Claudia Hildebrandt

Introducing AI Literacy in Schools: A Review of Pedagogical Approaches, Formats, Competence Areas, Evaluation Methods, and Inclusion of Data Literacy

Viktoriya Olari and Ralf Romeike

Literacy from Python 2

Lawrence Williams

## 14G : Computing Education in Elementary and Primary Schools

Time: 16:00-18:00, Room: Conference room B

How Elementary School Students Experienced Algorithms: Using Sorting Algorithms Online Learning Tool

Yuki Kitamura, Kazuya Hirose, Susumu Kanemune, Tomohiro Nishida and Shizuka Shirai

What is the Consequence of Getting a Greater Sense of Empowerment? – Longitudinal Cohort Study of Early Programming Education in Japan during the '80s and '90s –

Sayaka Tohyama, Yoshiaki Matsuzawa and Takito Totsuka

Symbiotic Approach to Mathematical and Computational Thinking

Kristin Parve and Mart Laanpere

Implications for Computer Science Curricula in Primary School: A Comparative Study of Sequences in England, South Korea, and New Zealand

Michiyo Oda, Yoko Noborimoto and Tatsuya Horita

## 15F : AGM 3.3

Time: 18:00-19:00, Room: Conference room A

## 15G : AGM 3.7

Time: 18:00-19:00, Room: Conference room B

## Monday, August 24

### 16 : Keynote Speech Dr. Hiroaki Ogata

Time: 09:00-10:30, Room: Dahlia

Data and Evidence-Informed Education and Learning in Post COVID-19



Registered participants can access all technical sessions via Howspace.

## Coffee Break

Time: 10:30-11:00

## 17B : Digital Education in Schools, Universities, and Other Educational Institutions

Time: 11:00-13:00, Room: Cosmos-1

Comparison of Causality-Influenced Logic Misreads by Nationality, Education, Occupation, and Gender

Koichi Hayashi and Noriko Shimada

A Social Media Simulator for Media Literacy Education in Japanese Schools and Universities

Atsushi Hikita, Tomohiro Inagaki, Marcos Sadao Maekawa, Shota Tajima, Yoko Miyazaki and Emi Nagasawa

A Practice of Game Exercises in Information Security Education

Yoshifumi Ueshige

Cross-Validating Four Measures of Technology Integration: Stages of Adoption, CBAM LoU, ACOT, and TPACK Core

Gerald Knezek, Rhonda Christensen and Anneke Smits

## 17C : Learning with Digital Technologies in Higher Education and for Life-long Learning

Time: 11:00-13:00, Room: Cosmos-2

A System to Realize Time- and Location-Independent Teaching and Learning among Learners through Learning-Articles

Seiyu Okai, Tsubasa Minematsu, Fumiya Okubo, Yuta Taniguchi, Hideaki Uchiyama and Atsushi Shimada

Awareness Support with Mutual Stimulation among People to Enrich Group Discussion in AIR-VAS

Mamoru Yoshizoe and Hiromitsu Hattori

An Approach to Personalized Quiz Based Learning

Noriyuki Iwane and Chunming Gao

Time-Shifting Method to Mitigate the Stagnation of Discussions to Promote Collaboration on SNS

Hideki Kondo, Sayaka Tohyama, Ayano Ohsaki and Masayuki Yamada

Understanding the Stakeholder Perspectives on Assessing Educators' Digital Competence

Linda Helene Sillat, Kairit Tammets and Mart Laanpere

Registered participants can access all technical sessions via Howspace.

## **17D : Computing Education in Higher Education**

Time: 11:00-13:00, Room: Ran-1

An Evaluation of the Flipped Classroom Approach Toward Programming Education  
Jun Iio

Cycles in State Transition as Trial-and-Errors in Solving Programming Exercises  
Taku Yamaguchi, Yoshiaki Matsuzawa, Ayahiko Niimi and Michiko Oba

Design and Practice of an Elective Python Programming Course in General Education  
Hajime Kita, Yoshitaka Morimura and Masako Okamoto

A Preliminary Report on Novice Programming with Natural Language Translation  
Momoka Obara, Teruno Kajiura, Shiho Takano, Yuka Akinobu and Kimio Kuramitsu

Teaching Computer Science Unplugged in Online for Undergraduate College Students  
Ben Tsutom Wada

## **17F : Computing Education in Secondary Schools**

Time: 11:00-13:00, Room: Conference room A

Curriculum Development and Practice of Application Creation Incorporating AI Functions;  
Learning during After-School Hours  
Kimihiro Takeno, Keiji Yoko and Hirotaka Mori

The Current State of Computer Education across the Australian Schools System  
Therese Keane and Milorad Cerovac

Pedagogical Adaptation to ICT in Australia  
Andrew Fluck

PICAPICA Z: An Interactive Smart STEAM Educational Approach via a Combination of  
Programming, Networking and Arts  
Issei Mukoda, Mizue Kayama and Takashi Nagai

## **17G : Computing Education in Elementary, Primary and Secondary Schools**

Time: 11:00-13:00, Room: Conference room B

ELSI (Ethical, Legal and Social Issues) Education on Digital Technologies: In the Field of  
Elementary and Secondary Education  
Nagayoshi Nakazono

Registered participants can access all technical sessions via Howspace.

Learning Effects of a Coding-based Board Game for Beginning Students Learning to Program  
Ryusei Takei, Daisuke Saito, Hironori Washizaki and Yoshiaki Fukazawa

Using R Language to Analyze Programming Learning Process of Ai. R-Cord utilizing AR  
Ryosuke Nakata and Tetsuro Kakeshita

Reflection Support with Summarized Screen Recordings of the Visual Programming Tool  
Kanta Kobayashi, Hideyuki Takada and Maki Ichimura

Validity of Animation When Finding Errors by Chuggington  
Yui Ono, Daisuke Saito, Hironori Washizaki and Yoshiaki Fukazawa

## **Lunch Break**

Time: 13:00-14:00

## **18 : Sponsored Symposium: Fujitsu**

Time: 13:00-14:00, Room: Dahlia

DX of Learning Materials in Japan; Development of Basic Skills and Abilities through Automatic Scoring and Establishment of Learning Habits

## **19A : Digital Education in Schools, Universities, and Other Educational Institutions**

Time: 14:00-16:00, Room: Dahlia

Characterization of Knowledge Transactions in Design-Based Research's Workshops  
Elsa Paukovics

Digitalisation of Education in the Global South: Conditions and Concerns  
Jaana Holvikivi

An Alternative Perspective on Computer Self-Efficacy Based on Group and Gender Composition  
Javier Osorio

Digital Literacy in Formal Education over the Past Decade: A Systematic Review  
Daranee Lehtonen, Vallery Michael and Jussi Okkonen

## **19B : Digital education in Schools, Universities, and Other Educational Institutions**

Time: 14:00-16:00, Room: Cosmos-1

High School Students' Approaches to Cheating in Remote Education During COVID-19

Registered participants can access all technical sessions via Howspace.

Pandemic in the Czech Republic

Miroslava Cernochova, Hasan Selcuk and Tomáš Podoljak

The Role of Technology in Communities of Learning Collaboration and Support

Gioko Maina and Janet Manza

## 19C : Learning with Digital Technologies in Higher Education

Time: 14:00-16:00, Room: Cosmos-2

A Taxonomy of Video Genres for Use in Education

Magnus Nohr and Halvdan Haugsbakken

Tracking Epistemic Interactions from Online Game-Based Learning

Eric Sanchez and Nadine Mandran

A Conceptual Framework for Automatic Generation of Examinations using Machine Learning Algorithms in Learning Management Systems

Emma Cheserem, Elizaphan Maina and John Kihoro

Layers of Knowledge Leading to E-Portfolios

Paul Libbrecht, Wolfgang Mueller and Sandra Rebholz

General Model for Design of an Integrated Learning Record Store System as Infrastructure in Learning Analytics on a University

Kazuaki Kojima, Makoto Miyazaki, Fumihito Furukawa, Takatsugu Yamamoto, Toshiyuki Miyahara, Kenji Tokumori, Hiroki Ebata and Hiroyoshi Watanabe

## 19D : Computing Education in Higher Education

Time: 14:00-16:00, Room: Ran-1

Improving a Model-Based Software Engineering Capstone Course

Michael May and Amir Tomer

Visualizing Class Diagram and Sequence Diagram of Java Program in VR Space

Tomoya Matsushita, Masateru Kishikawa and Tetsuro Kakeshita

Scaffolding Task Planning Using Abstract Parsons Problems

James Prather, John Homer, Paul Denny, Brett Becker, John Marsden and Garrett Powell

IDE Interactions of Novices Transitioning between Programming Environments

Ioannis Karvelas, Joe Dillane and Brett Becker



Registered participants can access all technical sessions via Howspace.

## **19E : Digital Education in Schools, Universities, and Other Higher Education Institutions**

Time: 14:00-16:00, Room: Ran-2

A Comparative Study of Different LMSs Used at Dokkyo University

Kai Li, Lumi Tatsuta and Ikumi Horie

Digital Innovation in Assessment during Lockdown: Perspectives of Higher Education Teachers in Portugal

Ana Amélia Carvalho, Daniela Guimarães, Célio Gonçalo Marques, Inês Araújo and Sónia Cruz

Analysis of the Process by Which University Faculty Members Come to Accept the In Assistant Faculty Development Support System and Use it to Reflect on and Improve Their Classes

Rie Emoto and Hiroshi Kato

A Study of Measurement of Mentoring Activities Using Text Mining Technology

Kaori Namba, Toshiyuki Sanuki, Tetsuo Fukuzaki and Kazuhiko Terashima

## **19F : Learning with Digital Technologies in Secondary Education**

Time: 14:00-16:00, Room: Conference room A

Using the SAMR Model as an Enabler to Computer Literacy for Grade 8 to 11 Learners in a Community Outreach Project

Pariksha Singh and Jayshree Harangee

Fostering Students' Resilience: Analyses towards Factors of Individual Resilience in the Computer and Information Literacy Domain

Kerstin Drossel, Birgit Eickelmann, Mario Vennemann and Nadine Fröhlich

Bridging the Learning Gap through Constructivist Teaching and Learning with Technology

Uchita Bakshani and Sandeep Wadhe

Creating an English Language Education System for High School Students Based on Multiple Intelligences Theory

Takeshi Nakamoto and Makoto Nakashima

The Paradox of Creativity

Lawrence Williams

Registered participants can access all technical sessions via Howspace.

## **19G : Computing Education in Secondary Schools**

Time: 14:00-16:00, Room: Conference room B

Twenty Years of Object Orientation – A Case Study for NRW in Germany

Arno Pasternak and Dieter Engbring

Assessing Engagement of Students with Intellectual Disabilities in Educational Robotics Activities

Francesca Coin and Monica Banzato

## **Closing Session**

Time: 16:00-17:00, Room: Dahlia



# SOCIAL PROGRAMME

At the WCCE 2022 Hiroshima Congress, a social programme was prepared for the morning of the third day. The reason for this is that August in Japan is hot, so we wanted to make use of the morning when it is a little cooler.

The following social programmes are prepared,

## Welcome Reception

The WCCE welcome reception will take place at the conference venue. This will allow onsite attendees the opportunity to make acquaintances and catch up with old friends in a relaxed environment.

**Date and Time:** 18:15 JST, Sunday, August 21, 2022.

**Place:** Dahlia Room in the conference venue

**Dress Code:** Smart Casual

## Banquet

The WCCE banquet will take place at the Rihga Royal Hotel Hiroshima, a 15min walk from the conference venue.

**Date and Time:** 18:30 JST, Monday, August 22, 2022.

**Place:** Rihga Royal Hotel Hiroshima

**Dress Code:** Smart Casual

**Participation fee:** 5,000 yen (Registration does not include Banquet fee)

<https://www.rihga.com/hiroshima>

## Miyajima, Itsukushima Shrine

Hiroshima have two World Heritage Sites - the Atomic Bomb Dome and Miyajima. From the pier near the A-bomb Dome, take a high-speed boat to Miyajima, home to Itsukushima Shrine. Itsukushima Shrine is said to have taken its present form in the 12th century. One of the symbols, the red torii gate, is unfortunately currently under construction, but this programme allows you to enjoy Miyajima, one of the three most scenic spots in Japan.

**Date and Time:** 23 Aug, departing at 09:00 and arriving at 13:00 (four hours).

**Capacity:** approx. 50 people.

**Participation fee:** approx. 5,000 yen (transport and entrance fees)



# SOCIAL PROGRAMME



## High School Visit

A visit to a high school not far from the venue will be organised to see how ICT-based learning, distance learning, etc. are actually being implemented. As this is just the end of the high school summer holidays, there may not be many high school students at the school yet, but you will be able to get a feel for the atmosphere.

**Date and Time:** 23 Aug, departure at 09:00, arrival at 13:00 (four hours)

**Capacity:** approx. 50 people

**Participation fee:** approx. 1,000 yen (transport costs)

## Mazda Museum

This programme includes a visit to the headquarters and factory of the automobile company Mazda in Fuchu-cho, Hiroshima Prefecture. The Mazda Museum, which was renovated this year, will show the history of Mazda and the spirit of automobile development, along with actual famous cars.

**Date and Time:** 23 Aug, departing at 8.30 am, arriving at 13.00 pm (four and a half hours)

**Capacity:** max. 40 people

**Participation fee:** approx. 2,000 yen (transport costs)

<https://www.mazda.com/en/about/museum/>

## Hiroshima Castle and Shukkeien Walking Tour

Walking from the venue and taking the tram on the way, the tour will take you to Hiroshima Castle and the samurai garden Shukkeien. The present-day city of Hiroshima developed together with Hiroshima Castle from the end of the 16th century. Please come and feel what Hiroshima was like in the Edo period.

**Date and Time:** 23 Aug, departing at 9 am and arriving at 1 pm (four hours)

**Capacity:** approx. 50 persons.

**Participation fee:** approx. 1,000 yen (admission and transport costs)





## Peace Memorial Museum

This museum tells the real story of the damage caused by the atomic bomb, and is located next to the International Conference Centre Hiroshima, the venue for WCCE 2022. Participants can enter the museum free of charge by showing their badge during the event!

On the morning of 23 August, a guided tour in English is also planned.



# REGISTRATION AND ASSISTANCE

## Registration Desk

On-site registration desk will open on the afternoon of 20 August, previous day of WCCE 2022, at the conference venue (ICCH). The registration desk will be available at the following date and time.

- 9:00 – 18:00 on August 21
- 10:00 – 18:00 on August 22
- 9:00 – 18:00 on August 23
- 9:00 – 17:00 on August 24

All registered participants can access all events, excluding social programme, via Howspace of the conference. Howspace will be available on the conference website:

<https://wcce2022.org/>

If you need further assistance, please get in touch with [info\\_wcce@a.ipsj.or.jp](mailto:info_wcce@a.ipsj.or.jp)

## Name Badge

Your personal name badge is your entrance ticket into all conference sessions. Please always wear your badge during the conference. No badge, no entry!

## Smoking Policy

Smoking is not allowed inside the conference venue.

## COVID-19 Care

The WCCE 2022 conference committee requests the onsite participants to

- Receive three times of the COVID-19 vaccination whenever possible;
- Refrain from visiting the venue in case of illness or fever; and
- Wear a mask, keep social distance, speak softly, and use hand sanitizer in the conference venue.

We shall also provide remote attendance for the WCCE participants. The details will be announced at the conference web site.

For the latest information on the COVID-19 epidemic in Japan and recommended infection control measures, please consult government publications and reliable news sources from time to time.

Ministry of Health, Labour and Welfare COVID-19 Portal

[https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000164708\\_00079.html](https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000164708_00079.html)



# REGISTRATION AND ASSISTANCE

NHK WORLD-JAPAN News: Coronavirus updates

<https://www3.nhk.or.jp/nhkworld/en/news/tags/82/>

## Wireless Networking

Free Wi-Fi access is available at the conference venue.

## Howspace Guide

This conference will be powered by Howspace, a social learning and collaboration platform. On Howspace, all registered participants will be able to find information about each presentation and other activities, access Zoom for events live streaming, watch presentation videos, read shared documents, and engage in discussion with other participants.

Howspace will be accessible for registered participants via the conference website.

# LOCAL INFORMATION



## Hiroshima City Transport

Public transport in Hiroshima City includes trams, JR lines, Astramline new transport system (AGT), many bus routes and airport access buses.

Trams are the most convenient way to reach the WCCE venue from Hiroshima Station.

Tram map: <https://www.hiroden.co.jp/en/s-routemap.html>

Trams run very frequently: the nearest tram stops to the WCCE venue, Hiroshima International Conference Centre, are A-Bomb Dome-mae (Nos. 2, 3, 6, 7), Hondori (Nos. 1, 3, 7) and Fukuro-machi (Nos. 1, 3, 7).

Most journeys are in the city's flat-fare areas, except when you are traveling to Miyajima by tram. The fare is 190 yen per ride. When boarding, ride from the rear door. The fare is paid to the driver or conductor when you get off the train. Exit at the door with the driver (or through the door with the conductor, if the conductor is present).

Most residents use transport IC cards. If you have one of the main Japanese transport IC cards (SUICA, ICOCA, etc.) you can use it.

## Traveler's Ticket

We recommend using the following traveler's tickets.

### 1-Day Trip Card

1-Day trip card is an economical ticket for traveling around Hiroshima and Miyajima. There are two types of access depending on the public transportation available. "1 Day Streetcar Pass" is available for all streetcar lines and costs 700 yen. "1 Day Streetcar and Ferry Pass" is available for all streetcar lines and Miyajima MATSUDAI KISEN tourist ship, and costs 900 yen. These tickets are not available on JR West Train. Also, "1 Day Streetcar and Ferry Pass" is not valid for JR Miyajima Ferry. You can buy these tickets at the Hiroshima Station Streetcar Information Desk (in front of the departure platform) or from drivers and conductors on the streetcars or Major Hotels in Hiroshima city. We recommend that you inquire at the hotel front desk as the number of tickets sold on the train is limited. If you want to take also a bus, please check "Visit Hiroshima Tourist Pass".

<https://www.hiroden.co.jp/en/e-1day.html>



## Visit Hiroshima Tourist Pass

This ticket allows free use of Streetcar, local buses in the Hiroshima City area, and Miyajima MATSUDAI KISEN tourist ship for days. A 1-day ticket is 1000 yen, a 2-day ticket is 1500 yen, and a 3-day ticket is 2000 yen. You can purchase at Hiroshima Airport, Hiroshima Station (North and South Transportation/ Tourist Information), and Hiroshima Bus Centre. You have to show your passport to verify that you are a traveler visiting Japan. Foreign tourists will receive a coupon booklet with discounts at tourist facilities and restaurants in Hiroshima Prefecture as a benefit of purchasing a ticket.

<https://www.hiroden.co.jp/en/e-vhpt.html>

## MOBIRY

A new service called digital ticket MOBIRY using smartphones at Hiroshima Urban Transit has also been launched. You can also try this out.

<https://www.mobiry.jp/en/>

## Hiroshima city share cycle

The community cycle system allows users to borrow bicycles at designated ports in each area and return them to their favorite ports within the designated area. To use this service, you must register through a dedicated smartphone application. A credit card is also required to pay the usage fee. The fee for the unlimited ride plan for 24 hours a day costs 1,100 yen. A single 60-minute ride costs 165 yen. You can also purchase One-day passes in cash at hotels in Hiroshima. For information on registration, usage, and purchase, please visit the following website:

[https://docomo-cycle.jp/hiroshima/en/pc\\_index.php](https://docomo-cycle.jp/hiroshima/en/pc_index.php)

## Useful links

Hiroshima official tourism website

<https://dive-hiroshima.com/en/>

Hiroshima Station Tourist Information Centre

<https://tic.jnto.go.jp/eng/detail.php?id=3298>

## Practical method of situated learning for programming involving interaction with a computer

Riko Takanohashi<sup>1</sup> Naoya Yamanaka<sup>1</sup> and Shinya Cho<sup>1</sup>

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**Abstract.** A computer program is a sequence of symbols that describes instructions to a computer, and programming is the process of designing and constructing an executable computer program. Therefore, when constructing a programming learning environment, it is common for the lectures to convey the grammar and the specific exercises to be done in sequence. However, for certain groups of learners, this may result in difficulties with continued participation in the learning environment. To overcome these issues, our research group has proposed a learning environment that focuses on "interacting with a computer" and "writing and sharing with others" based on the situated learning theory and Peirce's theory of inquiry, and has iteratively implemented it in various learning environments. In this presentation, the practical methods and results of a workshop conducted in an online environment our workshop in an environment where learners with diverse backgrounds are connected online, rather than in a face-to-face learning environment.

The workshop ran for a total of 12 weeks. Learners work in an environment where they can handle a programming language processor and work on handouts in which inferences are guided sequentially based on Peirce's theory of inquiry. Here, there are no grammar explanations in these handouts.

After the inferences and verification, the learners are guided to write down their experience in words. After a learner writes down a text, the next handout becomes accessible, and the learner can also view the writings of others.

Comparing the first three weeks to the last three weeks, the average number of executions per active user went from 115.0 to 110.6.

**Keywords:** Situated learning theory, Peirce's theory of inquiry,  
Interaction with a computer

## How Mature is m-Learning in an Education Institution?

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**Abstract.** An m-Learning Maturity Model (MLMM) is put forward in this research study based on Critical Success Factors (CSFs) for assessing the mobile technology adoption rates in universities and higher educational institutes. The model is derived and adopted from Capability Maturity Model (CMM), which has been widely used in organizations to gauge the adoption of various new technologies and processes. Five levels of m-learning maturity are defined in the model including preliminary, established, defined, structured, and continuous improvement. Each of these maturity levels is gauged through nine CSFs in assessment questionnaire. The CSFs used in measuring instrument of the MLMM model are adopted from three of our previous empirical studies. Using an assessment questionnaire and a rating methodology, the paper replicates the model to two universities to gauge their level of m-Learning adoption. Thus, two case studies are presented to assess the applicability of the model. Although the model has certain limitations in terms of omitting factors such as cultural influences on m-Learning adoption, the included CSFs have been validated by earlier empirical research. Hence the model provides a comprehensive approach, while opening new areas of future research.

**Keywords:** Electronic Learning, Mobile Learning, Learning Systems, Computers in Education, Capability Maturity Model.

## Stress from COVID-19 Disaster and Awareness of Learning: A Case Study of Japanese University Students

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**Abstract.** This paper presents a nationwide survey to investigate the relationship between stress and remote learning among Japanese university students during the COVID-19 pandemic. An online questionnaire survey of undergraduate and postgraduate students was conducted in July 2021, and responses were received from 2,096 respondents. Regarding the general stress university students undergo, factors I (depression and anxiety) and III (apathy) were higher for overall respondents and male students, while all three factors investigated [factors I, II (moody and anger), and III] were higher for female students than a previous study. The most common response was the lack of foresight about the future, such as employment and career prospects, regarding specific stress factors. The percentage of respondents who said that remote learning was the leading cause of stress was only 5.4%. Regarding university students' evaluation of remote learning, those who gave a positive review of 53.5% greatly exceeded those who gave a negative review of 17.7%. While the ease of understanding the digital materials is not so much of a problem, the difficulty in remotely asking teachers and friends questions make remote learning challenging to understand. From the analysis of the 900 free-text responses, "daily life" and "academic life" were extracted as the two broad categories related to the respondents' concerns, and eight and four subcategories were extracted respectively.

**Keywords:** Stress, College Students, COVID-19, Remote Learning, Japan.



## How ICT Tools Support a Course Centered on International Collaboration Classes

Shigenori Wakabayashi,<sup>1</sup> Jun Iio,<sup>2</sup> Kumaraguru Ramayah,<sup>3</sup>  
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**Abstract.** Here we describe a course centered on three international online collaboration classes. The participants were students at Japanese and Malaysian universities and the course used Information and Communication Technology (ICT) tools to contribute to university students' language ability, willingness to study, and knowledge about foreign and their own cultures. Various communication tools were used to support and monitor the project. The use of these ICT tools, including a newly developed application program (Dialogbook), will be presented. We describe how Dialogbook was used to set up small-group discussions, exchange comments, provide feedback between the instructor and students, and enable students' reviewing of their performance with rubric questions. The availability of such a one-stop support tool for students in the collaboration classes reduced the burden on teachers. The data collected with this application is closely examined, and the results show that the course successfully facilitated students' engagement in the project, with high motivation levels.

**Keywords:** application, collaboration, communication, English, group activities, ICT, international, language learning, motivation, portfolio, rubric.

## A Proposal for Intermediate Content: Transition from Visual to Text-Based Languages

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<sup>2</sup> Waseda University, Tokyo, Japan

**Abstract.** Beginners who study programming learn visual programming languages such as Scratch, while experts use text programming languages such as C and Java. However, a seamless transition from a visual programming language to a text programming language has not been established. Our research project aims to establish a methodology for the transition between the two types of programming languages. In this study, as part of our project, we focus on the features that an intermediate language between a visual programming language and a text programming language should have. In the first semester of 2021, we conducted a class for high school students using learning content, which creates music with JavaScript. The results of the post-lesson questionnaire indicated that this learning content had intermediate characteristics between visual and text-based programming languages.

**Keywords:** Visual-Type Programming, Text-Type Programming, Learning analytics.

## Evaluation of a System for Generating Programming Problems Using Form Services

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**Abstract.** Programming must be evaluated as a subject when taught in high schools. As a result, increasing the efficiency of question generation and grading has become a pressing concern. Waquema a system for automatically generating and grading programming problems that we created. Waquema is available in the following two versions: web (generates web pages) and cloud (generates Google Forms). At our university, we used the questions generated by Waquema's cloud version for exercises and exams in lectures. The system was then evaluated using a student questionnaire survey. We also conducted a questionnaire survey of the teachers who used the system and evaluated the time required for the exercises and examinations. The results showed that the difficulty level of the generated problems was appropriate for the students, and that the system could reduce the time required to prepare for the exercises.

**Keywords:** Programming education, Problem generation, Automatic grading

## How to quickly acquire basic knowledge in introductory programming with PBL: Clarify the relationship between drawing materials and textbooks

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**Abstract.** We believe that in higher education, students need to learn the basics of programming and how to use it, considering the continuity of primary and secondary education and its connection to society. However, traditional introductory programming courses for majors not specializing in information did not cover software development. Courses specializing in software development assume that students have already completed an introduction to programming, and we have given up on the idea of including both in a single course. However, we have realized a curriculum that includes an understanding of programming principles and knowledge of software development projects in 15 90-minute lessons (2 credits) using drawing materials. In the first half of the curriculum, students learn basic programming knowledge, and in the second half, they conduct a software development project in teams based on the knowledge from the first half. In the first half, we want to ensure the early acquisition of basic knowledge in preparation for a smooth transition to the second half of the curriculum. However, analysis of the submitted code revealed problems in selecting control structures and using abstraction. Revisions to the textbook based on these analyses resulted in a better understanding of control structures and abstraction. We discuss the understanding of the first half of the project, analyze the submitted assignments, and present the activities of the second half of the project.

**Keywords:** Programing Education, drawing materials, non-IT students.



## Information Design Education as Unplugged Computer Science Using School Library: Exercises of Information Organization Based on LATCH

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**Abstract.** In digital education, information needs to be organized in an appropriate manner. Therefore, the demand of information design education is increasing. Since information design includes a variety of contents, its education is diverse. Among them, the information structuring (information organization) was focused on this research. This research proposes exercises using the school library as information design education in secondary education. To organize the resources in a library, two types of structuring are used: classification and cataloging. These structurizations are useful as teaching materials for unplugged computer science in the study of information design. The exercises proposed in this study are based on R. S. Wurman's LATCH (The Five Ultimate Hatracks: Location, Alphabet, Time, Category, and Hierarchy) and involve organizing the resources of the school library in various ways. Through the exercises, students will learn the importance of organizing information, and how the way they organize information can change the way they see it. To utilize the school library for digital education, human cooperation between the teachers of information education and the school librarians is indispensable. For this reason, teachers of information education need to be aware of the value of school library on a daily basis. In an age when the organization of information and data is becoming more and more important, such as in the use of big data, classroom practices that utilize not only computers but also school libraries are expected to have a high educational effect.

**Keywords:** Information Education, School Library, Information Design, Information Organization, LATCH, Unplugged Computer Science.

## **Educational Support to Develop Socially Disadvantaged Young People's Digital Skills and Competencies: An Exploration on Collaborative Relationship's Contribution toward Young People's Empowerment**

Toshinori Saito

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**Abstract.** Digital skills and competencies are recognized as a challenge for the coming digital society. This paper contends that collaborative relationship established in educational support to develop socially disadvantaged young people's digital skills and competencies positively impacts young people's empowerment. Accordingly, findings based on four years of active research among a support group for socially disadvantaged youths in a provincial city in Japan and a discussion of such a relationship's impact on the support are presented. Our results suggest that collaborative relationships in the support can create a rich learning context and collaborative agency among supported youths, and computer programming in such relationships may generate cooperative memberships and a unique programming culture shared among them.

**Keywords:** Digital skills, Collaboration, Empowerment, Programming.

## Building Primary School Teachers “Technology” Capacity for STEM Programs

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**Abstract.** Modern technology is ubiquitous across all facets of life. The continuously evolving STEM (Science, Technology, Engineering and Mathematics) education landscape has provided an excellent opportunity to integrate the knowledge of digital technology to solve STEM-based project problems. However, there is no consistency in how STEM programs are taught across Australian primary schools. Whilst primary school teachers have integrated technology into their classroom, the teaching of the Technology discipline has been very patchy. Moreover, using technology such as computers is not the same as learning about computer hardware or about writing software to make it function. To achieve this, we need to educate and encourage students to become creators of digital solutions rather than consumers, which in turn requires primary school teachers to have the confidence and capacity to teach students this specialized discipline. To address this gap, this study focuses on primary school teachers' intentions, beliefs and perspectives on teaching Technology, as well as teaching STEM subjects overall. Understanding these beliefs and perspectives will help in building teachers' capacity and ultimately improving learning processes for primary school children. The paper reports on one phase of the project – a pilot study investigating the attitudes of primary school teachers towards meaningful integration of digital technologies in primary school programs conducted through the lens of the conceptual framework for the Dimensions of Attitudes towards Science (DAS). The preliminary findings demonstrate an urgency in addressing primary school teachers needs in getting access to knowledge and resources to build their capacity in the Technology discipline.

**Keywords:** Digital Technologies, STEM, Teachers Attitudes.

## An Interactive 3D CG Visualization of Speech Organs for Speech Therapy Education using MetaHuman

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**Abstract.** It is important for speech therapists and individuals with articulation disorders to understand tongue shape and movement in the oral cavity during speech. Existing educational materials mainly use two-dimensional (2D) images, limiting understanding of the complex three-dimensional (3D) shape and movement of speech organs in the oral cavity. In recent years, high-speed and high-quality 3D computer graphics (CG) visualization using game engines has been used in the field of education. In addition, MetaHuman Technology (Epic Games, Inc), a platform that can present a realistic human body in real-time by adjusting body parameters, was recently developed. In this study, we report our attempt to visualize the oral cavity using MetaHuman as part of articulation intervention.

The target speech sounds were [ta], [te], and [to], which form the basis of articulation training. First, we interviewed four experts (two dentists and two speech therapists) to understand the shape and movement of speech organs and existing educational materials. Video recordings were taken of ten Japanese-speaking adults without speech and hearing problems. Using the typical speakers as a guide, we applied the Control Rig and Sequencer features of the Unreal Engine (v.4.72) to generate CG animations of MetaHuman's mouth. In addition, we have created a visualization environment that allows observation from any viewpoint while freely selecting display formats such as "oral cavity only" and "tongue only", etc. The constructed system was evaluated by the experts in terms of its ability to understand the shape and movement of speech organs in the oral cavity.

All experts evaluated the system favorably in terms of "ability to observe tongue movement from various angles," "clear representation of airflow," and "usefulness in clinical practice with magnified image of the face and translucent oral cavity." However, there are some tongue shapes that are important in articulation training but cannot be reproduced with existing parameters, such as bilateral bracing and central groove formation.

The system has been evaluated for easy understanding of the shape and movement of speech organs and has potential for clinical practice. However, there were limitations in demonstrating the lateral movements of the tongue. We will continue refining high-quality visualization systems for speech therapy.

**Keywords:** Speech therapy, Articulation disorder, MetaHuman, Unreal engine.



## Practical Experiences of Using ICT for Online Architectural Design Classes Linking up Five Japanese Technical Colleges

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**Abstract.** The use of online classes is rapidly becoming widespread at Japanese technical colleges, due to the impact of the COVID-19. Online classes pose a major challenge in terms of achieving an educational effect at least equivalent to the practical vocational education hitherto delivered face to face. The objective of this study is to conduct an online demonstration lesson linking up five Japanese technical colleges, to shed light on whether online education also can deliver the interplay of experiences using ICT (experiential mode) and of reflection via workshops using pattern language (reflective mode). We conducted and examined the effects of a demonstration lesson enabling students to experience the interplay of the experiential mode via AR, VR, and other advanced technologies allowing environments to be visualized, and of the reflective mode via workshops using pattern language. The questionnaire revealed that the interplay between experiential mode and reflective mode also can be achieved in online education.

**Keywords:** Online design classes, Advanced ICT, Pattern language.

## **ShadowingPlayerPlus: Pronunciation Learning Application with Automatic Feedback/Repeat - Easy Pronunciation Exercise Method**

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**Abstract.** Shadowing is one pronunciation learning method that uses a method in which the learner listens to the audio of the material and then recites it almost at the same time. However, since shadowing involves both listening and speaking at the same time, it is very difficult for beginning language learners, and it has been found that learning is not very effective for beginners who are learning English as a second language (L2). This paper proposes a new learning method called LSF, which introduces automatic audio feedback to address the cognitive load problem of shadowing. We developed an iOS application for this method and conducted some trial learning experiments for English learners. The results of the experiments suggest that using this feedback method has an effect on learners' pronunciation.

**Keywords:** Shadowing, Pronunciation learning, Cognitive load

### **Training of Central Vein Catheterization in Virtual Reality with Real-Time Cross Section Visualization of An Anatomical Model**

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**Abstract.** In Central Vein Catheterization(CVC), an ultrasound is used to ensure safety. In this research, we propose a method to build the real-time ultrasound guide of CVC training in VR by visualizing the cross section of an anatomical model.

**Keywords:** CVC, VR, CrossSection Visualization, Ultrasound.

# Session 2F

## Designing Effective Student Engagement in the Digital Learning Environment by Using Concepts of MOOCs and Gamification

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**Abstract.** Handai Welcome Channel (HWC), an online video series, started in 2020 through the YouTube channel, was an emergency online learning support project for first year students because of campus closures caused by COVID-19. Although HWC is expected to deliver educational videos continuously, we theorize that it should be transformed to a digital learning environment for first year students. More so, passive online platforms such as YouTube are insufficient to increase student engagement. Therefore, we examined concepts of massive open online courses (MOOCs) and gamification related to student engagement to design a digital learning environment for the future HWC. As a result, we developed a prototype by using our experiences of creating and running MOOCs. Furthermore, while students are learning using the prototype, we also considered offering digital rewards to stimulate a student's interest by using elements of gamification. In this paper, we demonstrate a prototype of this digital learning environment called "Machikademia," designed as an effective student engagement tool. "Machikademia," is a video series of "Introduction to College Learning," which was produced and delivered on YouTube at the beginning of the academic year 2022 for first year students. We then designed the platform "Machikademia," combined with videos and quizzes. To motivate students to learn "Machikademia," we designed a digital wallpaper as a digital reward that can be downloaded after taking a quiz.

**Keywords:** student engagement, MOOCs, gamification.



## Different Time Zones, Different Cultures and Active Learning: Teaching Software Engineering Online

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**Abstract.** Software engineering is a field traditionally associated with a hands-on approach. The concept of active learning (as active involvement of participants in the learning process) has gained ground in the past decade in teaching various disciplines, including software engineering. Since 2020, as numerous courses started to be held online (in the newly named “emergency remote teaching” format), employing active learning proved to be challenging and its implementation had to be adapted to the new learning context. In teaching an introductory software engineering course at a national university in Japan, we gathered valuable experience of suddenly switching this course to an online format. In the past two years, participants in this course attended classes online, with many of them while in their home countries. There are many difficulties associated with this situation: from time zone differences to the inherent cultural differences. The latter form an important part of the focus of the instructor, who strongly believes that students from different cultural backgrounds respond to different teaching styles. Based on our empirical observations and on the students’ experiences, as expressed in end-of-class evaluation or questionnaires administered by the instructor, we concluded that there is no “one size fits all” approach to teaching an online class in a multicultural environment: some students prefer online classes, others prefer face-to-face; some participants respond better in small groups, whereas others thrive in big classroom settings. Our results show that 40% of the students prefer online classes, whereas almost 25% prefer face-to-face classes; at the same time, for more than 30% of the students, this depends on the class they are taking. In terms of cultural differences, almost 49% of the students consider that cultural differences are more visible in face-to-face classrooms and about 15% think that they are more visible in online classes; 20% of the students see no difference between the two. Moreover, more than three quarters of the students find the online class activities enjoyable and more than 90% find them valuable (either a lot or moderately). We can conclude that, despite the difficulties inherent to online environments and the cultural differences, the students have largely managed to overcome the existing challenges. For the future, cultural differences must continue to be considered when choosing the most appropriate format of active learning implementation.

**Keywords:** Active Learning, Emergency Remote Teaching, Multicultural Environments.

## **ParoTone : Development of a system to build a relationship between imitating and being imitated by instrumentalists through an intuitive interface**

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**Abstract.** The purpose of this study is to provide collaborative music learning for all individuals interested in playing musical instruments, including those with no prior experience. Playing a musical instrument is beneficial for children's cognitive development. However, because practicing piano or guitar requires long hours of practice to overcome difficulties, it is difficult to stay motivated and many beginners give up. Staying motivated is difficult and to solve these problems, we propose "ParoTone," a system consisting of two elements. the first element is the one-to-one correspondence between the five fingers, five buttons, and five lanes of sheet music. the second element is a system for users to share scores and establish a relationship of imitating and being imitated. We hypothesize that sharing scores and having others imitate you will motivate you to play your instrument.

**Keywords:** musical instrument, interface, imitation, motivation, collaboration.

### Evaluating Grading Fairness Using a Prediction Model: Comparison of Two Years Before and After COVID-19

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**Abstract.** It is important to maintain fairness in grading between different years. For example, it is problematic that the percentage of students who receive A grades suddenly increases because the instructors' grading has become easier, despite the same lectures. However, it is inevitable that the percentage of students who receive A grades will fluctuate from year to year in courses that use achievement assessment. Such a situation, how can we guarantee from the data that the fluctuation is not due to a blurring of the grader's criteria? This study proposes a procedure for analysis to ensure fairness in scoring using a predictive model. Using an actual face-to-face/online dataset from a Japanese university as experimental data, we examine whether the difference in the percentage of students obtaining A grades between face-to-face/online can be explained to some extent by differences in the achievement level of the student population.

**Keywords:** Grading Fairness, Prediction Model, Evidence-Based Education.

## Research on Enhancing Computational thinking of elementary school student.

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### Abstract.

Computational thinking (CT) is a general problem-solving skill. Introduced first by Seymour Papert (1980), it is introduced at the primary school level through computer programming. CT is a combination of various skills (Sequencing, Repetition, Conditional, and Decomposition). Recent research on CT has revealed its importance in computer programming as a foundation for coding.

Our research focuses on the enhancement of CT using cognitive puzzle activities. Throughout our research, we will be developing a Puzzle Game where students will be asked to solve basic elementary mathematics puzzle problems. These problems will be designed following the basic concepts of BODMAS (Bracket, Order, Division, Multiplication, Addition and Subtraction). This Game will be aimed at developing their Logical Thinking (LT). LT is a concept that feeds on all other aspects of CT and our hypothesis is that, an enhancement of LT will induce an enhancement of CT in elementary school students. The Puzzle Game will be having 3 levels of difficulties, with each level aiming at developing a specific aspect of CT.

The participants of this study were samples from students in grade 5 and 6 of an elementary school in Southern Japan. A three-day course has been designed where students will learn some fundamental concepts of programming with some review on mathematical concepts related to BODMAS. Cognitive questionnaires will be distributed throughout the course to the learners to evaluate them on LT concepts in relation with sequencing, conditionals, repetitions, and decompositions. Empirical data collected from these questionnaires will be used to assess their LT and CT throughout the course using a constant comparison analysis. If the results from our analysis indicate an enhancement in LT and CT, then we can confirm our hypothesis. This abstract is an overview of an ongoing research work that will be carried out for a period of 2 years. It is a small piece of cake in a project to help children in transitioning from visual programming to text-based programming.

**Keywords:** Computational thinking, logical thinking, constant comparison analysis, BODMAS.



## Developing Gender-Neutral Programming Materials: A Case Study of Children in Lower Grades of Primary School

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**Abstract.** There is considerable literature on ways to increase the participation of girls in the programming or computer science domains. However, further efforts are needed to foster “gendered innovations” activities in today’s digitalized world. In this study, we focused on facilitating a gender-free image of programming among young children using educational materials we developed. The developed learning materials have an opposite order of items each other using Scratch based on materials provided by the Japanese Ministry of Education: general material starts with introducing ‘move X steps’ while developed material starts with ‘say X’ and ‘when I receive X’ (message passing) to involve children in programming with limited mathematical operations. We conducted five rounds of afterschool programming lessons between November 2021 and January 2022 for two groups of four second graders (two boys and two girls) in primary schools using general and developed materials. The detailed analysis using transcripts from videotaped data of children’s construction process suggests that the developed materials were more effective for both girls and boys to support their construction process of the programming. Additionally, boys seemed to be helped more than girls by using the developed materials.

**Keywords:** Programming/Coding Education, Gender, Lower Primary School, Scratch.

## Robotics in primary education: a lexical analysis of teachers' resources across robots

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**Abstract.** Through lexical and statistical analyses, we study the relationship between the terms used in educational resources and the type of robots used in the activities described in those resources. These resources were authored either by novice or expert teachers in primary schools. Our hypothesis is that the computer science concepts discussed in an activity are different depending on the type of robot used in the activity. The first results confirm dependence between the type of robot and the lexicon used in the resources. The corpus of 120 texts is explored according to three thematic sets of terms: Computer Science (CS), Pedagogy and Move. Focused on CS terms, we compared the vocabulary used for sequential and event-driven programming robots, on the one hand, and the resources authored by novices or experts, on the other hand. For the set of resources using event-driven robots (Thymio and Ozobot), correspondence analysis and Pearson's chi-squared test show a significant difference between resources authored by novices and those written by experts. Experts have a significantly richer CS vocabulary (83 CS words) than novices (54 words). The lexical analysis suggests that these two event-driven robots are rather used to explore machine aspects (sensors, devices) and possible behaviors of both of these robots in their context. For sequential robots (Beebot, Bluebot), expert and novice resources are more similar. Beebot seems to be used earlier in the curriculum (for younger pupils) to discover a technical object (as a programmable toy). Bluebot is used later (by older pupils) to explore sequential programming notions: algorithm, sequence, instruction.

**Keywords:** educational robotics, event-driven programming, sequential programming, teacher education.

## Educating All Teachers in Informatics: Necessities and Strategies

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**Abstract.** The digital transformation in education increasingly requests teachers to integrate digital tools and devices into their professional activities. Since these tools and devices are the result of an informatics modeling process, teachers have to be trained in informatics, to competently select, use and adapt these devices and tools. Several approaches on how to train all teachers in informatics will be presented and discussed.

The symposium will contain contributions that aim to integrate informatics into specific subjects. David Baberowski, Christin Nenner and Nadine Bergner will report about their approaches on how to teach informatics to all teachers from primary to secondary level. Joyce Malyn-Smith and Irene A. Lee will present the Science+C project, a program where STEM teachers are educated on using, decoding and modifying computer models and simulations as well as Artificial Intelligence methods in Data Science. The teachers receive continuous support to implement these units in their lessons. A specific focus on how to integrate informatics with mathematics will be presented by Maciej M. Sysło.

The symposium will also contain contributions that are not solely focused on integrating informatics into subjects, but also into their daily lives as teachers. Daniel Braun, Barbara Pampel and Melanie Seiss will present the content including motivating examples of a course that aims to teach informatics to all teacher students, regardless of their subjects. Torsten Brinda, Ludger Humbert, Matthias Kramer and Denise Schmitz will discuss the concept and first results of an informatics lecture that focuses on activities of all teachers. The concept is not solely directed to teacher students but also aims at educating trained teachers without informatics background. Daniel Losch will present his approach on educating students about informatics modeling by means of textual representation using the LaTeX environment.

Finally, Ira Diethelm will report the work in progress of a working group of the German Association for Informatics on a recommendation for informatics competencies for all teachers.

**Keywords:** Digital education, Teacher education, Computer science, Informatics.

## Analysis of facial expressions for the estimation of concentration on online lectures

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**Abstract.** Online lectures such as massive open online courses become familiar. It is difficult for teachers to know whether students are concentrating on the contents due to the lack of interactivity in online lectures. The present study aimed to develop a method to estimate the state of attention from facial images while participating in online courses. We conducted an experiment to measure the level of attention as reaction time to detect the disappearance of noise sound while watching lecture videos, assuming that reaction time for the detection of contents-irrelevant noise is longer when learners are paying attention to the contents more. We sought facial features that are useful for predicting the reaction time. Reaction time can be estimated in some amount from facial features, suggesting that facial expressions are useful for predicting attention state, or concentration level while watching online video lectures.

**Keywords:** Attention, Facial Features, Online Lecture.



## Using a Cloud-based Video Platform for Pre-Service Teachers' Reflection

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**Abstract.** A cloud-based video platform was deployed into the pre-service PE teacher training course. One hundred and five students were enrolled in the course, and all demo lessons performed by students were video recorded and shared with the system. After each demonstration (demo) lesson, students were required to conduct two types of assessments by mark-up video with tags. As a result, the tags marked into each video clip were widely spread, and this suggest that it prevented a decrease in a student's concentration to observe them. The number of tags became relatively large in some teams, and this suggests that mark-up may be influenced by tags that were marked in advance by their peers. Except for a few cases, the duration recording of teaching episode seemed reasonably analyzed and marked with the system. According to the survey completed by students, most of the comments were positive. This trial gave a direct and visual feedback of the demo lessons, and it provided a good opportunity for students for their reflection.

**Keywords:** Cloud-based video platform, Microteaching, Reflection, Teacher training.

## Comparison of Teaching Environment in Hybrid-Flexible Class

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**Abstract.** Currently, the need for on-line classes is increasing due to the prolonged spread of Covid-19 infection. Hybrid-Flexible class environment is a method that allows students to take the same class in both in-person and on-line classes. A response is being taken to develop an environment that can provide advanced education using digital technology. Therefore, in order to propose an environment that can provide advanced education using digital technology, we evaluated three types of environments: in-person classes environment, synchronous on-line classes via video conference, and asynchronous on-line classes via courseworks. The in-person classes environment consists of "Projection screen", "LCD screen" and "LCD screen on the projection screen". While the synchronous on-line classes via video conference consists of "Projection screen with teacher", "LCD screen with teacher" and "PC screen sharing". The asynchronous on-line classes via courseworks is the same as the synchronous on-line classes via video conference. We reproduced each of these environments and asked students to evaluate them. The environments evaluated with 36 students were asked to rate the 9 presets on a scale of -2 to 2, with 2 being favorable and -2 being unfavorable.

The results of the experiment showed that the "projection screen" was highly evaluated in in-person classes. It was found that "LCD screen with teacher" was highly evaluated in synchronous on-line classes and asynchronous on-line classes. However, we found it difficult to combine these environments and found that simply providing the highly rated in-person classes environment as is resulted in lower evaluations in both synchronous and asynchronous online classes. We found that not only the current in-person class environment was delivered as is, but also the inclusion of LCD screen increased the level of satisfaction.

**Keywords:** In-person class, On-line class, Video conference, courseworks, Instructor

## Enhanced online academic success and self-regulation through learning analytics dashboards

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**Abstract.** In the wake of the COVID-19 health crisis, governments around the world made educational continuity during school and university closure a priority. Many countries adopted online education as an alternative to face-to-face courses. This situation has led to an awareness of the importance of analyzing learning traces and data left by students to measure, evaluate and improve the learning process. This paper presents an interoperable online learning analytics dashboard that allows teachers to easily track the progress of their learners as well as to predict and remedy dropouts. For learners, the dashboard offers the possibility to visualize their learning process, analyze it and develop better self-regulation skills. The results of the study conducted on a blended learning course, showed that the dashboard led learners to spend more time on their online training, to perform the proposed activities much better and to respect the deadlines better, and finally to improve their academic success.

**Keywords:** Learning experience, Learning analytics, Self-regulated learning, Learning analytics dashboards, Learner success.

# Session 5A

## Japanese Lessons on ICT in Education with GIGA school program

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**Abstract.** Japanese Ministry of Education (MEXT) advanced “GIGA school program” in 2020 to accelerate ICT use in Japanese public elementary and junior-high schools. From 2021, students in the schools started using personal computers which were distributed by the GIGA school program. In 2022, students in some Japanese public high schools started using personal computers for their learning, and remaining students will also start using personal computers by 2023. Lessons in the Japanese public schools are expected to change to use ICT effectively for enhancing students’ learning. Meanwhile, lessons in the Japanese private schools which started using ICT from earlier periods than GIGA school program are expected to provide the future lesson examples. In this symposium, we will introduce lesson examples in Japanese public elementary school, private junior-high and private high-school examples to overview Japanese situation of ICT use in education.

**Keywords:** GIGA school program, ICT in education, Japanese schools



## Features of Innovative use of Technology during the COVID-19 Period in India

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**Abstract.** The symposium aims to present four innovative practices of teaching and learning with technology in the COVID period among the government school (public) students and teachers in multiple states in India. These practices included: Use of WebQuest: Inquiry based learning through distance technologies for Madrasa (religious schools for Muslims that also include school education), Project-Based-Learning with Technology in F2F and online mode for students in Mumbai slums and Online certificate and digital badge course for school teachers on Constructive use of Technology in two states. Each of these practices substantiated at least one of the following features of innovative technologies as documented in the literature. 1. Collaboration: Use of multiple technology enabled platforms and pedagogies fostering collaboration among teachers 2. Deeper engagement: Creating and researching with technology leads towards deeper engagement and learning among students. 3. Adaptability: Technology offering adaptability and greater autonomy for teachers to engage in their professional development. 4. Transferability: Experience of use of project-based learning with technology in the F2F environment help transfer the skills required for this type of learning in the online environment. 5. Shareability: Technology enabled credentials promotes greater sharing among peers and education communities.

**Keywords:** Innovative use of Technology, Indian Government Schools, COVID-19 Lockdown Period.

## What students can learn about artificial intelligence – recommendations for K-12 computing education

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**Abstract.** Technological advances in the context of digital transformation are the basis for rapid developments in the field of artificial intelligence (AI). Although AI is not a new topic in computer science (CS), recent developments are having an immense impact on everyday life and society. In consequence, everyone needs competencies to be able to adequately and competently analyze, discuss and help shape the impact, opportunities, and limits of artificial intelligence on their personal lives and our society. As a result, an increasing number of CS curricula are being extended to include the topic of AI. However, in order to integrate AI into existing CS curricula, what students can and should learn in the context of AI needs to be clarified. This has proven to be particularly difficult, considering that so far CS education research on central concepts and principles of AI lacks sufficient elaboration. Therefore, in this paper, we present a curriculum of learning objectives that addresses digital literacy and the societal perspective in particular. The learning objectives can be used to comprehensively design curricula, but also allow for analyzing current curricula and teaching materials and provide insights into the central concepts and corresponding competencies of AI.

**Keywords:** Artificial Intelligence, Machine Learning, Computing Education, Curricula, Competencies, Learning Objectives, Digital Literacy

## How Do Students Learn in an Online Programming Course?

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**Abstract.** Due to the worldwide spread of COVID-19, online lectures have been conducted in various formats to continue learning at universities. While online lectures have various advantages, there is a problem in that the status of students cannot be monitored. In particular, in programming courses, there is a need to know the status of students during exercise sessions, because students often make mistakes while creating programs. In this paper, I analyze the recorded desktop screens of third-year students in a web programming course at Kindai University, categorize the problems, and propose content and methodological improvements with learning through online lectures.

**Keywords:** Video-Based Learning, Typing Error, Faculty Development.

## Web Application Development Achievement: Clarifying the Relationship Between Visual GUI Design and Textual Programming

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**Abstract.** To develop web applications, the design of graphical user interface (GUI design) is combined with textual programming. As these two practices are inevitably interconnected, the relationship between students' achievements in GUI design and textual programming should be a positive one. In order to improve instruction in web application development, this relationship should be clarified. This clarification is relevant because different kinds of GUI controls are available (e.g., standard controls, validation controls), which differ with respect to the complexity of their properties needed to be specified. To this end, this study used a sample of 36 second-year undergraduate students, who developed simple web applications through combining visual GUI design in the ASP.NET language and textual programming in C# language. By considering the students' web development achievements regarding this design and that programming, a strong positive relationship between them was found ( $r = 0.817$ ,  $df = 34$ ,  $p = 0.000$ ). The correlation between visual GUI design using validation controls and textual programming was  $0.831$  ( $df = 34$ ,  $p = 0.000$ ), whereas the correlation between visual GUI design using standard controls and textual programming was only  $0.545$  ( $df = 34$ ,  $p = 0.000$ ). Suggestions for practice and research are included.

**Keywords:** ASP.NET, C#, Standard Controls, Textual Programming, Undergraduate Students, Validation Controls, Visual GUI Design, Web applications.

## Shedding Light on Shadow: Leveraging Global Open Source and Open Standard for K12 and Higher Education

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**Abstract.** This session focuses on the prospective use of Global Open Source and Open Standard at higher educational institutions and K12 schools in order to advance teaching and learning, mitigating concerns, risks and pitfalls, and publishes “Hiroshima Declaration on Global Open Source and Open Standard toward Affordable Education on 2030”. Through the COVID-19 pandemic, the effectiveness of ICT has been widely recognized by all of stakeholders. However, its temporary implementation at scale for full online education to react to the COVID-19 pandemic within a quite limited time – a couple of weeks or a month - forced university and school to use ICT on the baseline of limited knowledges and resources. As the result, each university or school has been doing same things by different ways in some sense and sank up in a heterogeneous information environment. Because of the nature of Global Open Source and Open Standard collaboratively developed in its global community to realize the idea of re-use and interoperability of shared knowledge, the use may allow university and school to attain more efficient and effective information environment. This session starts with two plenary talks that have pre-recorded videos invited from the local and global communities. By sharing the video with captions in English and Japanese and allowing participants to have questions prior to the session, we expect to include more discussions during the live session from non-native participants. The second part followed by the plenary talks discusses the future of teaching and learning leveraged by Global Open Source and Open Standard through online discussions around the pre-recorded video presentations. Currently, we are planning to invite ten showcases in action from North America, Europe and Japan, which can envision the future of teaching and learning around 2030. This “flipped” panel discussion entitled “Shedding Light on Shadow” allows us to clarify the current pain points as “shadow” and its mitigation plans as “light” by using Global Open Source and Open Standard. Through the preparation of this session organized by our local moderator in Japan, we will deliver the declaration with the presenters as a tangible result of WCCE 2022.

**Keywords:** Open Source, Open Standard, Global Community, Interoperability, Re-use, Affordable Education.



## Foundations of Computer Science in General Teacher Education – Findings and Experiences from a Blended-Learning Course

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**Abstract.** With regards to the digital transformation, the consensus that computer science education plays a central role in shaping "digital education" is now emerging: Beyond the efficient and reflective use of information systems, new topics and methods arise for all school subjects that require computer science competencies and must be anchored in general teacher education. However, in light of students' heterogeneity, the question of how motivation, subject-specific demands, and applicability in subject teaching can be harmonized presents a particular challenge. This paper presents key findings and experiences from the research-led development and subsequent evaluation of a blended learning course offering. This course offering provides student teachers of all subjects and school types with basic computer science competencies for teaching in the digital world. On this foundation, success factors and good practices in the design of the course are identified. It is shown that the design of such courses can be successful if illustrative examples are used, communication and collaboration are promoted and, in particular, references and application perspectives for the respective subjects are taken into account.

**Keywords:** computing education, digital education, general teacher education, blended learning

## Panel Session Informatics Reference Framework for School

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**Abstract.** IFIP is a member of the Informatics for All coalition that has been working to develop the Informatics Reference Framework for School <https://www.informaticsforall.org/the-informatics-reference-framework-for-school-release-february-2022/>. This report, published in February 2022, advances informatics as a fundamental discipline for the 21st century, while also indicating how informatics may become a driver for renewal and innovation of other disciplines. In this panel session, members of the group who developed the framework, as well as others who have analysed it, will briefly outline and discuss its rationale and explain its focus and contents. Furthermore, proposals and suggestions for future developments related to this initial report will be outlined. The majority of the time for the panel session will be allocated to answering questions and addressing comments from the audience. Suggestions and comments from the audience will be fed back to the Informatics for All coalition for consideration in future development work. The authors of the report hope the Informatics Reference Framework and supplementary documents will be further developed over time and will encourage professionals in the informatics community to undertake more research, share thoughts and refine ideas.

## Distance Learning in Sports: Collaborative Learning in Ice Hockey Acquisition

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**Abstract.** Is it possible to induce collaborative learning in non-face-to-face learning? The objective of this research is to collaboratively support the sports skill acquisition process in non-face-to-face learning, which is currently growing and becoming widespread, and to study the characteristics of the cognitive aspects therein. An experiment concerning the ice hockey “stickhandling” skill was implemented in a non-face-to-face fashion, with two university students as the participants. In the experiment, a descriptive questionnaire was used concerning cognitive aspects in the acquisition process. The experiment was conducted over the course of eight months. The results of analyzing the descriptive questionnaire revealed a number of descriptions where the participant viewed the other person’s movements, aiming to improve their own movement. However, descriptions concerning improving the other subject’s movement could not be observed. In an analysis targeting online meetings, collaborative speech was observed. The findings suggested that in a non-face-to-face sports skill acquisition process, with merely an environment that allows for comparative study of the other person’s movement and thinking, it would be difficult for collaborative settings regarding the other person’s movement to occur. However, the possibility was mentioned for collaborative learning occurring with the addition of online meetings.

**Keywords:** Sports Skill, Non-Face-to-Face Collaborative Learning, Visualization System.

## Digital object-based learning with curated resources in university museums and libraries during the COVID-19 pandemic

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**Abstract.** This study explores the possibility and advantages of digital object-based learning with curated objects from university museums and libraries, especially during the COVID-19 pandemic. Object-based learning is as a mode of active or experiential learning that incorporates collections and objects into the learning environment, and recently, digital technologies have been installed into museums settings, such as virtual museums. This study demonstrates that object-based learning with digital technologies can gain student interest and enhance learning efficacy through students' online interactions in virtual museum settings through digital archives, with resources such as picture scrolls about Japanese domestic cows and manuals of Japanese native flowers. The author presented old texts through a contemporary medium for object-based learning. The findings show several advantages of digital object-based learning: 1) it has high accessibility, 2) it is safe to employ during the COVID-19 pandemic, and 3) it can be implemented in online and flipped learning.

**Keywords:** Object-based learning, Artworks, Books, University museums, University libraries.

## Development Plan and Trial of Japanese Language e-Learning System Focusing on Content and Language Integrated Learning (CLIL) Suitable for Digital Education

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**Abstract.** In the field of Japanese language education, even though it is very important to solidify the foundation of a learner's pronunciation ability, this area is sometimes neglected. This paper examines the development of digital education (DX) e-learning materials that can provide non-kanji-reading learners with authentic contexts and serve as a bridge to learning correct speech without causing them to feel psychologically intimidated. In addition, the courseware has been developed on Moodle, one of the learning management systems (LMS) in accordance with a pedagogical method known as Content and Language Integrated Learning (CLIL). We will also examine the results of comparative verification between Amazon Polly and Microsoft Azure using Text to Speech (TTS) and Speech to Text (STT) for voice materials.

**Keywords:** Distance Learning, TTS, STT, Moodle, Neural Voice, Japanese Language



## An easy-to-use screen capturing tool for supporting in-class CS learning activity

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### **Abstract.**

We have developed an easy-to-use screen capturing tool for learning CS education with exercises in class. This tool uses web API including MediaStream and MediaRecorder API to record and store screen capture video locally, which enables to send the most recent on-screen behavior when students need teachers' help. Our presentation describes the design and implementation of the tool.

**Keywords:** Computer Supported Learning, Screen Capture, Educational Web Application.

## Trends of Checklist Survey of Computer Operational Skills for First-Year Students – Over the Past Four Years

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**Abstract.** Information literacy has become extremely important not only in elementary and secondary education but in higher education as well. Thus, the quality of first-year information education must be improved. To do this, it is necessary to visualize students' information literacy and improve the curriculum accordingly. For the purpose of the study, the authors surveyed basic ICT (Information and Communication Technology) knowledge and developed a self-assessment checklist to assess computer operational skills. The checklist (designed as placement and achievement tests) contained a total of 40 items across four categories: (a) Computer operations, (b) Internet/e-mail, (c) Word, and (d) Excel/PowerPoint. Students selected an item if they could perform the operation described in that item. The authors conducted the study for over a four-year period with participation from 17,086 students at six universities in Japan. The results indicated that the placement test score in 2018 was lower than in other years, and the achievement test scores were markedly higher than the placement test scores in all years. By category, (d) Excel/PowerPoint had lower placement test scores than the other categories. However, even in category (d), achievement test scores were clearly higher than placement test. The results suggest that the first-year information education programs were effective in these universities.

**Keywords:** Information Literacy, Computer Operational Skills, First-Year Students, Self-Assessment Checklist.

## Response to Online Classes at Dokkyo University

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**Abstract.** Under the COVID-19, many universities suddenly were forced to shift from face-to-face classes to online classes in 2020. These responses at each university are various in terms of both response time and response methods. These are mainly related not only to computer and network problems but also to what the organization supporting users is. To enable online classes, it is crucial what kind of organizations support the users of the computers and how. Here, we explain the organizational responses, support, and tools provided by the University Faculty and students, as an example of Dokkyo University, which is a medium-sized private university in Japan.

Initially, we took two weeks to prepare for the online classes in April 2020. Using this period, we implemented the following three points. First, only about 30% of the students had computers, so they had to buy computers and equipment to prepare to take online classes at home. Then our university provided students with a grant of 100,000 yen and a guidebook for purchasing computers and other equipment. Next, we created websites and YouTube channel for teachers that explains how to conduct online lessons. We specifically showed some ways to make lesson videos. Finally, we also created a guide for students to show how to take online classes. In addition, the university signed up for Zoom, WebEx and, manaba as LMS. Then, we have managed to provide online classes to our students.

Now, multiple forms of instruction were given, depending on the infection status and type of classes. For example, face-to-face, live, hybrid, on-demand, and so on. To avoid being too close together, classes for over 100 students needed to be online in 2022. On the other hand, small classes such as seminars and languages were face-to-face.

Over the past two years, the class environment for students and faculty has rapidly changed. While both faculty and students can take online classes regardless of where they live, there are many students who make only their attendance but do not participate. Moreover, online classes tend to have more assignments and keep students and faculty busy. We need to analyze the current situation involving many advantages and disadvantages, and seek better education.

**Keywords:** Online Learning, Learning Support, COVID-19.

## Analysis of a Real-time Online Course with Flipped Classroom Using Digital Diamond Mandala Matrix

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**Abstract.** In order to empower students proactive, interactive, and deep learning, various efforts have been made at universities. We designed a course with the goal of these types of learning referring the idea of the “Castle Top” Diagram proposed by Dr. Fink. We will show our practice and the results of analysis of the course. In designing the course, a flipped classroom was adopted to keep time for presentation and discussions. In addition, we used our digital Diamond Mandala Matrix (dDMM), which is like a mind map with text field, to support students to organize and share their ideas on a browser. dDMM is very effective on real-time online classes because size of the area for input is strictly defined so that students can share with a single screen all their ideas. The target course was an online Basic Course of the Universe at a Japanese university in the fall semester of 2021 (90 min times 15 weeks). 139 students were joined to the course from every grade of various departments. Students participated in the course as follows. (1) Preparation. Students get basic knowledge from videos and materials prepared by the instructor. Then, they individually research to fill pre-learning dDMMs with theme given by the instructor. (2) Real-time online class. Students give presentation using their pre-learning dDMMs, and discuss each other. Sometimes, group work is held to make a group dDMM based on pre-learning dDMMs and discussions. (3) Review. Students complete post-learning dDMMs individually by recalling what they discussed on the real-time online class and researching. Students repeat (1) through (3) several times with different themes among the course. We performed text data analysis on the text field of the pre-learning, group work, and post-learning dDMMs using KH Coder to observe their changes through the learnings. It is found that the vocabularies used in dDMMs changed significantly from the first week to after the final week, especially largely for students of liberal arts departments than for those of science departments. It is revealed that through group work, students become to think more realistic, which is observed on the change of the combination of nouns and verbs from the pre-learning dDMMs to post-learning dDMMs. Thus, course design using dDMMs of pre-learning, presentation and group work and discussions on real-time online class, and post-learning encourage students to share ideas to broad their perspectives in thinking which led them to consider more realistic observed on dDMMs.

**Keywords:** Online course, Flipped Classroom, digital Diamond Mandala Matrix, Text data analysis, KH coder

## National policies and services for digital competence advancement in Estonia

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**Abstract.** Estonia is a tiny North-European country that was eager to realign its governance and education systems to democratic Western values as soon as it escaped from the ruins of Soviet Union in 1991. Within last 25 years, systematic educational reforms have resulted with a success story of Estonian school system. Just like the rest of the EU, Estonia has prepared the national strategy for the next 15 years and this strategy focuses on a smarter, digitally transformed and sustainable economy and society. Digital competence of citizens is an important prerequisite for wide-scale digital transformation in the industry and society at large. This paper describes and analyzes the coordinated activities on the national level to create a coherent system of services for assessing, developing and making use of digital competence among learners and teachers on different levels of education. The special focus is on collaboration between various stakeholders in the recent policies, frameworks and instruments related to teachers' and learners' digital competence development in Estonia.

**Keywords:** Digital competence, competence frameworks, education policy, digital innovation.



## Non-English-based programming

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**Abstract.** Most of Japanese tend to find programming languages very difficult, since they have to use English-based language. Japanese mainly start to learn English from Junior high school. English is a language barrier for most of Japanese children to learn programming. We give you workshops for world-wide educators, especially for non-English-speakers. We are preparing some Non-English-based programming.

**Keywords:** Viscuit, Non-English Programming, creative activities, collaborative learning

## Evaluation of a Data Structure Viewer for Educational Practice

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**Abstract.** Data structures and algorithms are fundamental subjects in the curricula of information science faculties and departments. Recently, they were also included in the curriculum as basic subjects of data science and artificial intelligence.

In 2017, we developed a smartphone application, termed Data Structure Viewer (DSV), to promote the understanding of data structures and algorithms. This application has been used in our lectures. In this article, we describe the evaluation of the DSVs used in lectures from 2017 to 2021 through the use of questionnaires. The students' evaluation and confirmation of the lecture content in class, revealed that the DSV contributed to the improvement of students' comprehension. We also discuss important points to be considered when using this smartphone application in lectures.

**Keywords:** Data structure, Smartphone application, HyFlex-type lecture.

## Development of Education Curriculum in the Data Science Area for a Liberal Arts University

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**Abstract.** Data science has emerged as a field that will revolutionize science and industry. The development of human resources for data science has become an urgent issue in every aspect of the digitizing society. However, a curriculum to meet the needs in such a digitizing society is not available to higher education in Japan, especially in the realm of liberal arts. Such liberal arts students do not have enough basic math education such as statistics before entering the university.

In response to the required situation of the approved program for Mathematics, Data Science, and AI Smart Higher education, we proposed a conceptual curriculum model for the data science education program, which systematically incorporates the knowledge module of data science while remedying the weakness in the basic math skills and barriers to be considered in the process of learning data science concepts.

The goal of this paper is to propose an integrated curriculum based on the conceptual model for the faculty members in a small-sized private liberal arts university, where students lack basic math skills, IT skills, and the basic knowledge of data science. Issues consist of the curriculum on knowledge area and subjects, the implementation approach of data science education courses, and the fusion of data science with expertise education are discussed. A sample course will be showcased at the end.

**Keywords:** Data Science Education, Liberal Arts University, Curriculum Development, Conceptual Curriculum Model.

## Improving motivation in undergraduate data science education by using dilemma problems

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**Abstract.** The purpose of Introductory data science education for undergraduate students is to increase students' interest in data science and improve their learning motivation. In this study, we designed a class using a dilemma problem based on a case study of the use of AI technology in job interview. To investigate the change of motivation in this lesson, the students were given a questionnaire before and after the class. As a result, it was found that this class had an effect on the motivation to learn data science. The in-class tasks have the students aware of their interest in AI, and it helped to improve their interest in data science as well. In this paper, we discuss the effectiveness of motivation to learn data science on interest in AI.

**Keywords:** Data science education, Undergraduate programs, Dilemma problems.

# Session 9B

## Digital Technologies in a STEM curriculum

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**Abstract.** In the Netherlands, the elective course Nature, Life, Technology (NLT) was developed between 2007 and 2016. At present it is taught at approximately 45% of all upper secondary schools (grade 10-12). The course has been introduced and developed in the Netherlands from 2007 on. After a subsidized period of 10 years some 80 modules were available that deal with interdisciplinary themes, combining elements of science, mathematics, technology and general and technical skills. The course is taught by a team of teachers. A school's NLT team determines itself which modules it wants to cover within the examination program. Therefore the examination itself is school specific.

The general aims of NLT are to make the different science disciplines more attractive and challenging by offering students insight into new – often interdisciplinary - developments in science and technology and to create coherence in teaching and learning specific STEM subjects. Moreover the course intends to stimulate students to choose for a vocational or university study in one of the separate disciplines or for an interdisciplinary study.

Since 2016 the course material has been kept up to date and developed further by the NLT Association. Schools offering the course can become a member of the Association and pay a membership fee of €1,500 per year. To this end, the existing modules are maintained, new modules are developed and professional development of the teachers is carried out. The Association currently has about 220 members.

A new initiative of the Association is to define learning trajectories dealing with two very relevant currently leading themes: “Sustainable Development” and “Digital Technologies”. A thematic learning trajectory starts with a so-called “transition module” in the course of grade 10. In that module, the prior knowledge of the theme is collected and bundled. An overview is then given of the theme, which lays a foundation for other modules in which the theme will be developed further or at least plays a significant role. For example, the Digital Technologies learning trajectory consists of a transition module and modules such as Artificial Intelligence, Robotics, Particulate Matter, Quantum Computing.

The session at WCCE2022 will offer a closer look at the theme Digitale Technologies and will deal with the question which elements of ICT literacy and digital technologies are important within this theme and what role NLT (a STEM curriculum) can play in this.

**Keywords:** Digital Technologies, STEM, Curriculum development.



## LeaP- Quest in Madrasahs of West Bengal, India during COVID-19 Pandemic: Perspectives, Opportunities, and Challenges

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**Abstract.** The Covid -19 pandemic made the world come to a standstill. The entire education system had to shift to online mode to continue their teaching-learning process. This sudden shift to the online mode led the online classes very much monotonous in nature and started resulting in students' loss of learning interest.

This paper talks about the approach used to tackle the situation through conducting various LeaP-Quests which is a blended lesson format (synchronous and asynchronous) designed by combining the approaches of constructive learning (Jonassen, D. 1999) and inquiry-based learning (Pedaste et al 2015).

This paper also describes the process of designing of the LeaP-Quests by TISS certified Master Trainers along with the resource team at CETE TISS and implementation of LeaP-Quests in upper primary, secondary, and higher secondary Madrasahs of West Bengal, India to encourage students' active participation and promote constructive and inquiry-based learning as well as shares examples, and instances from a few LeaP-Quests. In addition, this paper attempts to bring about perspectives of teachers and students on how LeaP-Quests have helped them to increase the learning interest through exploring new technology applications, conducting in-depth research to create and present artifacts, interact with experts from various fields and participate in live quizzes despite all the challenges being faced by the stakeholders.

**Keywords:** LeaP-Quest in Madrasah, Constructive and Inquiry based learning, Innovative ways to continue teaching and learning in COVID-19

## Digital Education in the Post-Covid Era: Challenges and Opportunities to Explore

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**Abstract.** The COVID-19 pandemic (from mid-March 2020) took most educational systems by surprise, forcing million educators and students to radically change how they teach and learn. Online teaching was forced for about 1.5 years and, during this period, digital technology played a major role in enabling teachers to teach students at a distance using various digital platforms and tools. The purpose of this paper is to explore the challenges and opportunities that come with online-digital education, in the post-COVID era. Opportunities to explore include the integration of digital education in the educational system, adoption of appropriate (mobile) pedagogies, more flexible and mobile forms of teaching and learning, reconsideration of National policies, redesign of curricula, improvement of institutional infrastructure, creation of educational resources, and enhancement of students' and teachers' digital technology (and online pedagogy) skills. With regard to learning from the crisis and moving forward in the post-COVID normal, some recommendations are finally addressed.

**Keywords:** Digital Education, Post-Covid, Opportunities.

## Design and performance of video interview in a MOOC

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**Abstract.** Videos play a fundamental role in online courses and are a valued resource among learners. On the other hand, the development, design, and use of videos in Massive Open Online Courses (MOOCs) are poorly understood, a matter that is reflected in current research. For example, research on use of videos in MOOC is primarily approached from a learning analytic perspective which means mapping of user patterns and performance of videos in online courses. In fact, we find few studies that outline the design work and the use of different video genres in MOOCs. That said, the goal of this paper, is therefore to explore the learning design process and the performance of a particular video genre that is seldom studied in online courses, video interviews. To examine this matter, the paper explores the learning design process of using video interview and how it performed in a MOOC by analyzing click stream data. The study finds that the video interview genre can have a high degree of view completion rate among learners.

**Keywords:** MOOC, video, interview, learning design.

# Session 9C

## Users' Satisfaction and Effectiveness in Practice of e-learning: Midlands State University, Zimbabwe Case Study

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**Abstract.** Many educational institutes have adopted technology for learning purposes. This adoption has been either planned or forced due to the COVID19 pandemic. There is need to understand e-learning experience from users' perspective and effectiveness in practice. This research considers users' satisfaction measured from community of inquiry point of view and effectiveness in practice measured from qualities of learning point of view. This research is based on the e-learning experience at Midlands State University (MSU) in Zimbabwe. Overall users are not satisfied with their e-learning experience (about 37% satisfied) and perceived ineffective in practice. Technology could play a vital role in learning thus measures need to be put in place to increase users' satisfaction and effectiveness in practice. There is need to support the user to enable affordable access to e-learning and leadership support to improve e-learning practices.

**Keywords:** Users' Satisfaction, E-learning, Community of Inquiry, Qualities of Learning, University.

## Text-mining Analysis of what students think about e-learning and face-to-face class on account of COVID-19.

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### Abstract.

**Background:** Because of COVID-19, many universities in Japan have carried online classes out instead of face-to-face classes from the beginning of the new semester of the 2020 academic year, from April to March of the next year. Initially, full online classes were carried out. From fall in 2020, face-to-face classes were partially carried out. This study has been carried out to investigate what university students think about the parallel situation of online and face-to-face classes, and to think what kind of possibilities are now and in the post-COVID-19 eras.

**Methods:** The data used in this study have obtained from the free response essays submitted by "Computer Literacy" class students in Kwansei Gakuin. Data have been collected four times for different students respectively; at the end of Spring 2020 semester, at the end of Fall 2020 semester, at the end of Spring 2021 semester, and at the end of Fall 2021 semester. The sample number of data is 358. Text mining method was carried out to analyze the free response essays.

**Results:** The results of the text-mining analysis of the students' free-response essays show that the students' opinions and impressions of the parallel situation of online classes and face-to-face classes are as follows: Generally face-to-face classes are more preferred because of opportunity to meet friends, easy communication with teachers and other students, or higher motivation to learn. On the other hand, students have found advantages in online classes. For instance, students have no need to go to the university, and they can learn anytime and anywhere in case of asynchronous online classes.

Full online class students in Spring 2020 have significantly different features. They often use these words; "how to use", "first", "for the first time", "get used to" and so on. They did not just have a face-to-face guidance.

**Conclusion:** Although most of students basically prefer face-to-face classes to online classes, they also think online classes to be good. Learning materials have to be enriched for online classes, and students think it to be good. Next, it seems that continuous observation and care are necessary for students enrolled in 2020, since they were forced to attend online classes from the beginning of the entrance. Furthermore, it will be harder to gather students in a classroom than before the COVID-19 crisis.

**Keywords:** e-learning, online class, face-to-face class, COVID-19.



## Development and Evaluation of a Field Environment Digest System for Agricultural Education

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**Abstract.** Smart agriculture has grown rapidly because of the development of the Internet of Things, such as drones and sensor networks. Farmers can manage farm fields effectively using agricultural sensing information, such as the temperature and humidity in their fields. It is important for young farmers and students in agriculture courses to develop decision-making skills based on such information. In recent agricultural education, field management systems have also been used for managing farms based on field sensing information. For example, temperature and humidity are visualized in graphs of time series data or heat maps of field temperatures to provide students with field sensing information. However, it is difficult for students to analyze such various sensing information because the students need to be familiar with the knowledge of agriculture and field sensing information. In addition, students have a variety of tasks, such as acquiring knowledge and growing crops, and they cannot devote their time solely to studying sensing information analysis. To solve these problems, it is necessary to provide field sensing information that is more easily understood and handled. Therefore, we proposed the Field Environment Digest System to help students analyze field sensing information. In addition to conventional visualization methods, our digest system provides two visualization methods: one is to summarize field sensing information as statistical information, and the other is to extract periods considered important from field sensing information based on change detection. In addition, we analyze how students use the system to investigate the effective use of field sensing information in agricultural education. For this purpose, this system can collect the students' operation logs. From the results of our experiments, summarization of field sensing information can help students analyze the field sensing information. In addition, our digest system provided multiple uses to the students. We found that students using multiple digests were likely to describe more details, such as specific sensor values.

**Keywords:** smart agriculture, agricultural education, educational support system.

## Developing Teaching and Learning Innovations; a Case Study of Indo-Finnish Collaboration

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**Abstract.** The objective of this collaborative case study paper is to outline the action plan for joint Indo-Finnish collaboration between Tampere University (TAU), Finland, and the University of Agricultural Sciences Dharwad (UASD), India. Background, needs, and challenges for thematic teaching and learning area development of “smart agriculture and entrepreneurship (SAE)” is introduced. Smart agriculture plays a greater role in building a digital ecosystem for next-generation agriculture and food systems, entrepreneurship, and collaborative learning across the modern collaborative, interconnected and interdependent globalized world. Both India and Finland enjoy friendly relations for more than 70 years, in recent years the collaboration has also focused on strengthening collaboration in fields such as Future ICT, Future Mobile Technologies and Digital Education, Circular Economy, and other fields. The Govt. of India has given prime importance to the entrepreneurship and the startup ecosystem in Agricultural Universities. In addition, the State Governments are also supporting entrepreneurship at State Agricultural Universities. The UASD has started first of its kind project, The World Bank and Indian Council for Agricultural Research funded the “National Agricultural Higher Education Project (NAHEP) and Institutional Development Plan” in order to achieve the potential benefit of exploring the rich experiences of the alumni in developing and imparting industry defined curriculum aimed at entrepreneurship development through mentoring and enhancing the career prospects of the graduates. The UAS Dharwad is collaborating with Tampere University in this project to get the best global experience for faculty and students. As per the action plan, the students of UASD will be completing the first of its kind Hybrid international training on SAE (online training in India and Onsite training in Finland), by the end of June 2022 at TAU Finland. Similarly, the UASD Faculty had also undergone International Training at TAU Finland. Previous collaboration has created trusted relationships with these two universities and the stakeholders of them. In the future, we are looking forward to connect and enlarge networks of Nordic universities through the collaboration of NCI i.e. Nordic Centre in India and also foster inter-Indian collaboration of higher education institutes in the areas of agriculture, such as UASD, information technology institutes, and business schools, in India.

**Keywords:** Teaching, Learning, Innovations, Smart agriculture, Entrepreneurship, Institutional Development, India, Finland.

## Where is Technology in the ‘Golden Thread’ of Teacher Professional Development?

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**Abstract.** Researchers and policy makers have consistently agreed that the quality of teachers is one of the most important factors in determining the quality of an educational system and that teachers need to be supported and developed through rigorous initial teacher education and continuous professional development. In the specific case of teachers’ ability to make effective use of technology, it has been noted that teachers require both technological and pedagogical training and education that equips them with the knowledge, confidence and skills they need. Given this broad, international consensus about the importance of teacher education for effective technology use, this paper explores the ‘golden thread’ of teacher development proposed by the UK government for teachers in England. This sets out a detailed curriculum for teacher development with very little reference to educational technology. The paper considers some of the potential missed opportunities to develop teacher expertise and practice with technology.

**Keywords:** Teacher Education, Education Technology, Teacher Training, Professional Development

## Professional, Higher and Vocational Education in ICT: IFIP WG3.4 Working Conference Papers Over the Years

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**Abstract.** The International Federation for Information Processing (IFIP) working group WG3.4 – *Professional, Higher and Vocational Education in ICT* was established in 1971, and this paper describes the papers presented at the WG3.4 Working Conferences from 1984 (the earliest conference for which we have any data). WG3.4 is focused on education leading towards careers or professional development in some form of computing. IFIP runs several different types of conference that are relevant to the goals of WG3.4 – its World Computer Congress (WCC), involving all its Technical Committees, including TC3, the World Conference on Computers in Education (WCCE), involving all TC3 working groups, and individual TC3 working group conferences. This paper deals primarily with papers presented at WG3.4 working conferences. A total of 406 papers were published from these conferences, on a variety of topics related to Professional, Higher and Vocational Education in ICT. Authors came from 178 research institutions in 51 countries. Since 1984, WG3.4 conferences have been held in: Australia, Czech Republic, Estonia, Finland, Germany, Hong Kong, Israel, Japan, Norway, Singapore, Tanzania, The Netherlands, and Zimbabwe. In this paper we list the important topics covered at each conference and provide a grouping of papers on specific topics. We then investigate how these topics have changed over the years. To do this, we make use of Historical Research methodology to identify important article topics and trends.

**Keywords:** IFIP, Working Groups, WG3.4, Working Conferences, Papers, Professional, Higher, Vocational, Education, ICT.



## Symposium: Informatics in Primary Education: Approaches, Current Issues and Lessons Learnt

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**Abstract.** The introduction of informatics at primary level is attracting increasing attention in education systems across the world. Some countries have already embarked on this journey while others are initiating similar transformations or are beginning to explore how it can be included at this level. It is a challenging process to which there are many facets and a diverse range of implementation approaches can be adopted. The complexity is also evidenced in the range of terms to describe it e.g. informatics, computing, computer science. However, for the most part, the overarching aim is to initiate *compulsory and systematic development of computational thinking (CT) for all learners at primary level*.

Due to this diversity and the stages of development in implementing informatics education, it is necessary and productive to share experiences, discuss strategies, successes and challenges, and inform each other about ongoing research projects and their findings. In this symposium, we examine some recent developments in those efforts including curricula, teachers' professional development, informatics concepts and CT skills, related educational research activities and other topics of interest. We also share what are the issues encountered in various countries. Our ultimate goal is to provide some new perspectives on current challenges.

The symposium comprises of a series of thirteen short contributions arranged in three clusters, focusing on various *approaches, challenges and lessons learnt*.

**Keywords:** Informatics, Computer Science, Computing, Primary Education, Curriculum, Programming, Robotics, Computational Thinking.



## Improvement of Fill-in-the-blank Questions for Object-Oriented Programming Education

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**Abstract.** We have developed a programming education tool, named pgtracer, which provides fill-in-the-blank questions in C programming. Pgtracer provides programs and a trace table with blanks. A trace table is used to represent the execution of the target C program. As a result of our research, we could estimate the achievement level of the students and clarify the answering process by analyzing the logs collected by pgtracer. To improve software quality and reusability, object-oriented technology is important from various perspectives, and there is an urgent need to train engineers proficient in object-oriented programming. Thus, we are extending pgtracer to Java programming. Trace tables are extended to represent individual instances and message sending among the instances. In this paper, we created fill-in-the-blank questions for Java programs and attempted to have students solve some of the fill-in-the-blank questions using the "embedded answer (Cloze)" question format of Moodle's question function. The results of the trial were discussed, and improvements were made to the questions and the user interface. We also introduced the notion of ignorable blanks which students do not need to fill. This type of blank is useful to increase the variety of questions.

**Keywords:** Learning Analytics (LA), programming education, object-oriented programming, Java, fill-in-the-blank question.

## Automated Reporting of Code Quality Issues in Student Submissions

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**Abstract.** Despite its importance in industry, code quality is often overlooked in academia. A number of automated tools to report code quality have been developed but many of them are impractical to use. They either are developed as a standalone tool, require the use of a particular IDE, and/or need historical data. This paper presents code quality issues reporter (CQIS), a tool that can be embedded in an assessment submission system; it identifies code quality issues for each student submission via static analysis, and reports those in an HTML page whose link is sent via email. The tool covers 52 code quality issues specifically curated for academia, 32 for Java and 20 for Python. According to four quasi-experiments with a total of 274 students, students with CQIS are likely to have fewer code quality issues so long as the expected solutions are long and complex and code quality is considered as part of the marking. These students are also more aware of code quality, and readability in particular.

**Keywords:** Code Quality, Static Analysis, Automation, Programming, Computing Education.

## Mitigating accidental code plagiarism in a programming course through code referencing

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**Abstract.** Code plagiarism -- taking code from external sources and using it in one's own programs -- can be a serious issue for programming students, depending on the policies being applied by their instructors. However, plagiarism can be inadvertent, due to a lack of knowledge among students. Our research shows varied understandings of correct code reuse, suggesting that students are not provided with appropriate guidelines. Our goal is to introduce good code referencing practice to students, to help raise students' awareness of academic integrity and reduce the possibility of accidental plagiarism. We present Corona, a code referencing system that can assist students in creating references for their code while simultaneously educating them about ethical code reuse. Technical evaluation of the system shows that Corona can successfully generate references for code taken from 20 of 24 distinct programming assistance websites, and that it can find matches between students' code and instructors' example code and generate appropriate references. Our research in a small-scale environment suggests that the use of Corona as a demonstration tool in a lecture about code referencing increases student awareness of correct referencing practice. To improve our intervention, we also show steps that lecturers can take to further elevate students' participation in code referencing.

**Keywords:** Code Referencing, Code Similarity Detection, Comment Generation, Academic Integrity, Programming, Computing Education.

## Coding Education for Adults Through Distance Learning in Japan

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**Abstract.** In this paper, we describe the current state of informatics education in Japan. Next, we describe the importance of programming education for working adults. We held classes on programming for working adults at two universities: University of Shizuoka and the Open University of Japan. The former used Google Colaboratory to provide an online class on Python programming. In this class, we prepared the teaching materials for the lecture and used Google Colaboratory as a programming environment for students to practice. Then, we described the results of the questionnaire to the students that we conducted after each class. At The Open University of Japan, programming materials were built in the Google Colaboratory environment, and the classes were conducted using those materials. Though the two universities used Google Colaboratory differently, it was found to be a useful tool for teaching programming to working adults for the following reasons: First, the environment is cloud-based so that the students don't have to prepare the environment locally; and the second, it's relatively easy to use for novice users.

**Keywords:** Coding education for adults, Python programming, Online lecture

## Programming Education at Tokyo Online University

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**Abstract.** Tokyo Online University was established in 2018, with two faculties, one of which is the "Faculty of Information and Management", which provides engineering education based on a curriculum referring to J07-IT, which refers to IEEE/ACM CC2001-CC2005. In this paper, we describe how we have been working on educational activities that involve exercises, mainly programming. We will discuss difficulties with programming education in distance learning, showing statistics of students' learning logs. We show that we are making some efforts to overcome the various difficulties in distance education with practical training and exercises. In addition, we discuss the renewal of the curriculum that is planned after the completion of the four-year "aftercare period" in 2022.

**Keywords:** Distance Learning, programming education, online judge system



## Hybrid Mode of Counseling for Student Startups – A Success Story of University of Agricultural Science Dharwad (UASD), India

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**Abstract.** Startups are being promoted among students to explore the young minds in generating ideas for field problems. India has become the third largest ecosystem in the world after US and China. A record of 41 startups achieved unicorn status in 2021. The government is encouraging students to take up start-up journey that contribute to economic growth as well as creates employment opportunities for others. Efforts are made under World Bank-assisted National Agricultural Higher Education Project (NAHEP) to create a startup ecosystem in farm universities. University of Agricultural Sciences Dharwad (UASD) under the Institutional Development Plan (IDP) has attempted to promote startups among the students. The process involved orientation on opportunities, encouraging students to generate ideas for a specific problem, ideation workshop to pitch in the idea, mentorship, technical and financial assistance in prototype development, and product standardization for up scaling. The process was initiated in February 2019 and ideation workshops were conducted in four constituent colleges. Sixty groups of students presented total of 72 ideas before the experts. They were short listed based on technical feasibility and utility to target users. Digital media such as phone calls and online meetings were used to counsel the students due to COVID 19 situation and continued with the validation process in the field. After the validation process, students were encouraged to develop prototypes under the guidance of university mentors. Twelve groups were able to develop prototypes and test them in the field. Modifications were made based on the feedback and the product was standardized for commercial production. Four groups of students were successful in commercializing their product. Their products are being applied for the patent. The students expressed that it was difficult for them, in the beginning, to understand completely and follow the advice, but frequent interaction and online meetings were helpful in clarifying their doubts. The process appeared slow in the beginning, but with time it was most convenient as they were able to save time in visiting their mentors personally. The experience revealed that a hybrid mode including digital media and guidance in person results in greater success than relying on a single mode of communication. Even in normal times, the combination of digital and offline communication systems is effective, especially for the promotion of startups.

**Keywords:** Counseling, Student Startups, hybrid mode, digital media.

## Prediction of Engagement from Temporal Changes in Facial Expression

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**Abstract.** It is important for teaching to keep paying attention to students' engagement levels. Previous approaches for investigating students' engagement used subjective judgments by other people looking at learners' faces as ground truth (e.g., Whitehill et al., 2014). The present study used the performance of arithmetic tasks as an objective index of engagement levels, and investigated whether facial expressions are useful to estimate engagement levels in terms of the time required to finish a calculation (response time, RT). For facial expression analyses, we used temporal changes of facial features in predicting RTs in addition to the features themselves. Participants added or subtracted in mind between two numbers. We assumed that RT variation among trials is caused by the change in a learner's engagement level from trial to trial when task difficulty is kept constant. Facial images were recorded during calculation, and facial features were extracted later as action units (AU, Ekman and Friesen, 1978) using an open source software, OpenFace (Baltrušaitis et al., 2016). For data analyses of several second data as in our experiment, means, standard deviations, and maximums of AUs are usually used. In addition, we calculated a slope of temporal change of each AU during a trial to focus on the dynamics of the engagement. With all of these indexes, a machine learning method, LightGBM (Ke et al., 2017), was used as the model to predict RTs. The result shows a statistically significant correlation between RT for correct answer trials and predicted RT from facial feature indexes. The prediction accuracy was evaluated as the root mean square error (RMSE), comparing with the RMSE around the average of the data (baseline). The RMSE against model prediction is 4.24, which is smaller than the baseline RMSE of 7.99. That is, the model explains 40% of data variance. We, then, analyzed the prediction accuracies for the model with slope indexes and that with others. The RMSE for the model with slope indexes was 5.34 and that for the others was 4.86, and a statistical test showed that both were smaller than the baseline ( $p < .001$  for both cases). We also found the RMSE for the model with slope indexes was larger than that with others, which could be explained by the difference in number of indexes used (there were 17 slope indexes and 63 others). The present study revealed that facial features can be used to estimate the level of engagement during learning, which could be applied to online learning system.

**Keywords:** Engagement, Facial Features, Machine Learning.

## A Practical Report of Online Class between Japan and the Philippines in COVID-19

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**Abstract.** The system of overseas partner institutions is meaningful not only for students but also for professors. It allows students to learn expertise that is not available in their own culture. On the other hand, teaching students from different cultures is an excellent opportunity for professors to shed new light on their field of study. Unfortunately, COVID-19 has prevented them from traveling abroad. At this point, professors have no choice but to either give up this opportunity or attempt online classes. Some have tried their best to meet the immediate needs for new educational methods and introduced their online teaching practices. However, the methodology has not yet been established. One difficulty is that not all professors have enough computer knowledge and IT skills to follow the practice reports and conduct online classes. Therefore, practice reports filled with unfamiliar terminologies and equipment names will not encourage and facilitate these professors but discourage them. This tendency is particularly true with older professors, who no longer like trial and error in teaching. However, their expertise and experience accumulated over a long period should be shared among students of partner institutions majoring in the specialized area. This presentation will report an interactive online class connecting Ferris University in Yokohama (Japan) and the University of the Philippines in Quezon (the Philippines) conducted by an aged female professor with no online teaching experience using minimal equipment and PowerPoint slides. In Japan, it is generally believed that women and older people are not good at operating machines. So this report will encourage all the teachers who are hesitant to try online teaching. This presentation will also show the problems to clog up class proceedings and the tips to solve them. According to the class survey, students highly appreciated the opportunity to learn new expertise directly from foreign experts through this online class, and they hope to continue such courses. Although COVID-19 has brought difficulties and confusion to classes, it has also brought suggestions for new educational possibilities. We will consider the new prospects for online courses after COVID19 based on the student survey.

**Keywords:** Minimum equipment, No special IT skills, Japan and the Philippines.

## The Research for Supporting Gifted and Talented Pupils in Metaverse

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**Abstract.** This presentation will present the use of metaverse spaces for gifted children and support for their placement. Although gifted children are often highlighted for their high ability, they often struggle with their relationships with their surroundings and often stop attending school because they do not feel fulfilled in their learning. In order to improve this situation, interviews were first conducted with parents and guardians to determine what kind of support is needed. The authors then prepared a space where gifted children from all over Japan could gather by utilising the Metaverse space, and conducted support activities centred on dialogue with university students to satisfy their own intellectual curiosity. In this presentation, the author introduces the content of the interviews with parents in particular and these support activities and describes the direction of future research.

**Keywords:** Gifted and Talented, Metaverse, Inclusive Education.



## Rubric Self-Assessment System for Technical Standards

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**Abstract.** Rubrics are often used to guide instructors in grading student work, but they are also useful as a tool for self-assessment. We have developed a generic skill assessment system as a learning tools interoperability (LTI) tool that enables self-assessment of generic skills. The rubric and checklist data model used in the system is compatible with IMS Competencies and Academic Standards Exchange technical standards (CASE). This study shows specific use cases in which the system is applied to self-assessment beyond generic skills. The rubric self-assessment system has been implemented in three cases: an information literacy course, a programming course, and a nursing training course. The system allows students to self-assess more easily than other methods, such as self-assessment using spreadsheets. In the system, students self-assess by clicking on the rubric criteria displayed on the screen, and the LTI tool allows students to use the same rubric across courses in the learning management system. Therefore, self-assessment results can be managed chronologically for each rubric.

**Keywords:** Rubric, Self-Assessment, LMS, LTI, CASE.



## e-Readiness of Teachers and Scientists of Farm Universities: A Case Study in India

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**Abstract.** e-Readiness is a prerequisite for taking advantage of information and communication technologies for development (ICT4D) and can be operationally defined as the readiness or preparedness of people to use various forms of ICTs in their daily life. The study was undertaken in Karnataka and Kerala to assess the institutional e-readiness of the State Agricultural Universities (SAU) and Research Institutes of the Indian Council of Agricultural Research (ICAR). Thirty teachers from the University of Agricultural Sciences Dharwad (UASD) & Kerala Agricultural University Trissur (KAUT) and 30 scientists from ICAR research institutes were selected to assess institutional e-readiness by a simple random procedure. E-Readiness was assessed using the scale developed for the purpose. The scale consists of five dimensions that include ICT infrastructure, software, human resources, IT security, IT policies, and legal framework. Data were collected by personal interview method using a structured schedule. The index of readiness and component wise readiness was calculated using the maximum possible score and obtained scores. The study revealed that the overall e-Readiness index of SAU was 64.89 percent as compared to ICAR which recorded 69.10 percent. The dimension of human resources at SAU was higher (78.17 %) followed by Information Technology (IT) security (74.09 %), IT policies and legal framework (61.90 %), software (59.24 %), and ICT infrastructure (58.54 %). While in the case of ICAR human resources was found to be 79 percent followed by IT policies and legal framework (77.14 %) and IT security (74.09 %). The study observed that ICT infrastructure was higher for ICAR (63.75 %) as compared to SAU (58.54 %) while the dimension of software was found to be higher (63.64 %) in ICAR as compared to SAU (59.24 %). The human resources component was on par at both ICAR (79.00 %) and SAU (78.17 %). The study recommends that farm universities must invest more in software and security for effective use of ICT. The application of computers should be used for creating documents pertaining to teaching and research. e-Readiness determines the potential of e-resource use, hence institutions need to strengthen all dimensions of e-Readiness.

**Keywords:** e-Readiness, Human resource, ICT infrastructure, IT security, Software, SAU, ICAR

## Detection of Synchronized Head Movements from a Single Classroom-Scene Video

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**Abstract.** Estimating the level of student engagement is important for teachers to make their classes more appealing. Synchronicity of head movements may be an indicator of engagement because engaged students tend to raise their heads and look at the screen or blackboard when important information is being presented. This study investigated whether the synchronicity of head movements can be estimated from video images alone. Nineteen participants (university teachers and students) listened to student's presentation. A camera with a frame rate of 29.97 fps was set up at the front of the classroom to record the movements of the participants. The head positions of participants were estimated from video images by using MMPose (<https://github.com/open-mmlab/mmpose>). It was necessary to cancel the effect of the seated location because the position was estimated as a set of coordinates, with the upper left corner of the video frame as the origin. We calculated the relative positions of the nose and chest in the horizontal and vertical directions, and normalized them by dividing the size of the detected person. Normalized nose position was used as the head position. The correlation of head positions between a given pair of participants was calculated (Inter-person correlation). We observed synchronicity of head movements among participants when a speaker was presenting important information on a screen at the front of the classroom. The participants looked at the screen to see the important information, which resulted in high IPCs. Synchronicity of head movements may provide information to teachers to know whether their lectures successfully attracted attention.

**Keywords:** Head movement, Synchronicity, Engagement.

## Proposal for a Flipped Classroom Model to Promote Autonomous Learning

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**Abstract.** Learners in higher education need to develop learners' competency through autonomous learning with knowledge acquisition in various situations of lectures. In a previous study, we proposed a flipped learning model in which learners do preparatory learning using computer-based training system (CTS) and check the understanding degree at the beginning of a class using computer-based adaptive test (CAT) (Ueno et al. 2017). According to the findings, this model contributes positively to the improvement of the learners' levels of knowledge understanding. However, there is still a problem that autonomous learning is slightly restricted because a personal work assigned during the class time is provided at the start of the class and should be solved in time.

In this study, we revised our model. that moved up learning activities of the CAT and the personal work before the class time, that had been performed in class time in the previous study.

The class model proposed in this study consists of textbooks, quizzes, lectures (videos), CAT, and assignments, all of which are conducted outside of class time in order to promote self-regulated learning. Textbooks, quizzes, lectures (videos), CAT were administered via e-learning, and assignments was administered individually at home, all online. Only group work was conducted during class time. The classes were conducted using online meetings. The model allows learners to select voluntary when to work on learning activities at any time using online environment. Consequently, learners are expected to learn more autonomously than ever before.

We perform and evaluate a case study of programming classes. In order to confirm that autonomous learning took place, we investigated whether learning outside of class time became fluid. It was found that more than 60% of the learners learned in a different order from the teaching model of the previous study. In addition, when the final grades were compared, it was confirmed that the grades were comparable to those of the previous study. In other words, it was found that knowledge proficiency was ensured even when learning became fluid.

**Keywords:** e-learning, autonomous learning, flipped classroom.

## Problem-Solving University Educational Program Using Collaboration between Medicine and Design

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**Abstract.** Design (art and engineering) can apply innovative solutions to problems in the medical field. Although there were many ways to collaborate between design and medicine, collaboration as an education program is limited. We launched an educational project aimed at addressing medical problems through design. Here, we introduce that program and report on the 1st-year results.

The program was implemented in a class (once a week, two 90-minute sessions) at the Graduate School of Design. The participants were 14 graduate students from the Graduate School of Design and four volunteer graduate students and faculty members from the departments of surgery, oral surgery, and nursing at the Graduate School of Medical Sciences and Hospital. First, a hospital tour was conducted to identify problems. We then conducted workshops for problem finding and idea development using the KJ method. Subsequently, we divided the participants into three groups, and each group produced prototypes for selected ideas. We evaluated items related to “skills for creativity” and “creativity minds and motivation” using a five-point Likert scale, which was based on a survey of design education in medicine and research on evaluating STEAM education using design thinking. The participants evaluated themselves before and after the class. Professors also assessed participants after the class. Pre- and post-class evaluations were analyzed with corresponding t test at a 5% level of significance.

In all, 192 problems were found and 221 ideas were created; three prototypes were developed: a dental chair for infants (oral surgery); speech therapy games for children (oral surgery); and a warm water dispenser for hair washing (nursing). In the subjective evaluation, we obtained the following results evidencing a significant increase after the class: able to share work with others before it reached personal satisfactory level ( $P = 0.01$ ); able to express ideas quickly ( $P = 0.05$ ); desire for future work related to medicine and design ( $P = 0.01$ ); and the design experience in medicine would be useful for personal career development ( $P = 0.03$ ). The average objective rating after the class was  $3.9 \pm 0.4$ .

Collaboration of design and medicine as an educational program has the potential to create unique ideas and positively influence the creativity skills and mindset of participants.

**Keywords:** Problem-Based Learning, STEAM, Medicine, Design.



## Imagine, a Smartphone costs 100,000,000 yen...

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**Abstract.** In this poster, a small tale is shown, which the presenter created for making young people understand the circumstances of late 1960s to 70s. In the era there were only so expensive mainframes that nobody cannot buy computers by oneself. The tale is as shown below: Imagine such a world like this..... Although there are smartphone shops, a smartphone costs 100 million yen, or about one million US dollars. So no person can buy it by him/herself. Only large universities or companies will buy it - buy only one. Many people share the only one smartphone placed in their university or their company - during daytime and nighttime, one person after another uses it. However, most students or employees are not permitted to use the smartphone by him/herself. Instead there is a specialist for operating smartphones, who will operate it. The smartphone is somewhat strange one – it has no screen. There are only some buttons like “start” or “stop.” It has no keyboard or mouse like those for personal computers. Ones must write everything which he/she wants to enter to the smartphone in advance – write on papers of designated format, and give it to the smartphone specialist who will input it on your behalf. For printers, there are big and noisy ones. There are no apps, which means they do not exist in the world. So anybody who want to do anything with a smartphone will make their own apps by him/herself. People who cannot make apps will either give up using smartphones, or give some money to someone else and ask to make one. People who once achieved to make an app will be impressed, because the smartphone works as he/she thought, and will be absorbed in making apps. However, he/she does not have a smartphone by themselves. So he/she will go to the “smartphone room” day by day..... This was the real world of late 1960s to 1970s. In those era “smartphones” were called “large-scale computers” or “mainframe.” Although they were “large”, their performance were far less from that of today's smartphones. “Smartphone specialists” were called “computer operators.” “Smartphone room” was called “Computer room” or “EDP room.” (EDP means Electronic Data Processing). Nowadays smartphones will work without making software by users themselves. But both in the past and now, there exists an app / program only because somebody has created it. And that smartphones / computers will never work without them. Young people who will create their own programs, not satisfied only with using existing software, are the same as we were in the old days, who went to the “Smartphone Room (Computer Room)” day by day. The presenter anticipate to young people’s creative programming.

**Keywords:** Smartphones, Mainframes, History, Imagine.



# Session 10A

## Workshop Computational Thinking in Teacher Education

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**Abstract.** This workshop demonstrates and practices with the participants exemplary activities from a comprehensive collection of newly developed open teaching and learning materials from a project team from 10 different countries. First, we give an overview of the materials that aim to support teacher educators of prospective teachers of all school types and school levels in teaching computational thinking. The material is primarily aimed at teacher educators and teachers in primary and secondary schools in those subjects that include computational thinking content (languages, humanities, arts, STEM, etc.). The material covers methodological aspects of teaching, introductory activities, and specialized and advanced aspects of computational thinking education. After that we will engage the participants in a series of learning activities conducted in small groups. These computational thinking learning activities are mostly unplugged. Participants' devices, laptops or mobile phones, may be used for plugged activities. The workshop ends with a discussion of emerging questions and specific topics such as assessment of learning computational thinking, plugged vs. unplugged, teaching methodology, etc.

**Keywords:** Computational Thinking, teacher education, practical experiences, unplugged activities.

## EdTech as an empowering tool: Designing Digital Learning Environments to extend the Action Space for Learning and foster Digital Agency

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**Abstract.** Educational Technology (EdTech) can be both empowering or constraining depending upon the underpinning design. This paper delineates some of the design aspects that warrant careful consideration by designers and developers of EdTech applications such as digital learning environments (DLE). Building upon the literature on digital agency and microworlds we begin to argue that for educational technology (EdTech) to become an empowering tool the design of educational technology (EdTech) should expressly cultivate learner's digital agency and extend action space for learning through a manipulable microworld environment. Digital agency encompasses aspects of competence, confidence and accountability - capabilities that an empowered learner needs to possess in order to meaningfully and autonomously engage in a DLE. Subsequently, drawing from our experiences of designing EdTech enterprise solutions for a large scale EdTech intervention in India we demonstrate that exercising digital agency is possible when DLEs provide manipulable action space in a microworld where learners can own the dynamics of environment through variables and controls, of course, under certain constraints. We also define action space for learning (ASL) as a cognitive-pedagogic construct and through examples argue that a thoughtfully designed microworld extends the ASL for learners. Throughout this paper, we supplement these design based profferings with findings from a large scale EdTech intervention in India. Finally, we conclude with recommendations for further research and a call to investigate potential of EdTech as an empowering tool employing an action-oriented approach for teaching and learning.

**Keywords:** EdTech, Microworld, Action Space for Learning, Digital Agency, Digital Learning Environment.

# Session 10B

## Five Years of Experience in Improvement of a Technical English Class using Information Technologies

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**Abstract.** We have tried several ways to make students enjoy technical English classes for five years. We made assumptions about students in our department, designed the class which may be effective to achieve the purpose of the class considering the assumptions. We implemented the class and acquired the feedback from students after that, in the first year. We modified the assumptions and designed the next year's class to cope with the problems which became clear by the feedback. We also implemented the class by the design and acquired the feedback from students after that in the second year. We are improving the class by repeating this cycle every year for five years. We confirmed some assumptions are true and the improvement is going well by feed-back from students. We show the improvement using the ADDIE model. We also show some quantitative analyses about this class.

**Keywords:** Active Learning, ICT tools, Learning Analytics.

## Transnational Pedagogy and Global Teaching of Noh Theatre: Initial Reflection on Teaching Noh Theatre online during the Pandemic (From Philippines to Canada)

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**Abstract.** This paper foregrounds some initial reflections on collaborative teaching of Noh Theatre online to Canadian theatre students by scholar-artists and faculty members of the University of Winnipeg and University of the Philippines. The Department of Theatre and Film offers students a wide experience of acting and performance styles through various performance courses. One of these courses is Acting Theory and Practice (ATAP) which is a fundamental performance course that engages the students who are interested in exploring theatre as a pedagogic discipline, artistic expression, and social inquiry. In this course, the students are expected to attend Laboratory Acting Classes that “emphasize practical study” of the craft of acting that “include exercises and discussions which connect theoretical to the practical components of the course.” Actors training in post-secondary theatre schools in Canada has deep roots from Russian theatrical performance technique conceived by Constantin Stanislavski. On building a global practice of theatrical practice, the ATAP students of Winter 2022 underwent a departure from Western theatre acting technique via a Noh Theatre online performance workshop facilitated by a Filipina-Canadian actor trained by Naohiko Umewaka Naohiko Umewaka who is a Noh master for Shite of the Kanze School. Aside from the workshop, the introduced the students into the theatrical philosophies of Noh Theatre and a short demonstration of Noh performance. All these events, were conducted via Zoom. Before the pandemic, the course is taught in-person. Shifting from an in-person to an online teaching mode, the authors of this paper will share their experiences of working collaboratively in negotiating the challenges of online teaching of Noh Theatre during the pandemic and how this ancient Japanese theatrical convention was taught via Zoom to cultivate an adaptive pedagogy through digital platform forms.

To respond from WCCE 2022 - IFIP TC3 World Conference theme’s on Computers in Education Towards a Collaborative Society Through Creative Learning, the authors would like to engage in a discussion on “the importance of ensuring digital equity and e-inclusion and how we can achieve this for communities widely. Thus, the authors in this paper ask: How an embodied theatrical form like Noh Theatre was taught through a mediated technology? What are the compromises that the facilitators have had to negotiate to allow equity in learning Noh Theatre within the limits of technology? To what extent transnational pedagogic collaboration on digital e-learning of traditional Asian theatre forms like Noh Theatre empowers acting students creativity?

**Keywords:** Noh Theatre, Innovation, Canada-Philippines

## Trends in Event Styles of Medical Research Meeting in Japan

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**Abstract.** With the spread of COVID-19, academic events had to cancel, or shift the style to online or hybrid. However, the exact number of these event situations has not been reported. This study clarified trends in event styles of medical research in Japan from registered event data in a web service. Text mining was used to extract and classify event styles such as on-site or online events. As the result, it is revealed that the total number of events dropped sharply in March 2020, but in November 2021, it was recovered to the same level of the peak month in 2019. The number of online events has increased since March 2020, and has become the majority of event styles by December 2020. The number of hybrid events increased later than online and accounted for approximately 20% of the total in June, October and November, 2021. The online and hybrid contributed to the continuation of the academic events under COVID-19. Although it is expected that online will be reduced after COVID-19, hybrid has the potential to become a popular style that includes diverse participants.

**Keywords:** Medical research, hybrid meeting, online meeting, text mining.



## Simulating fieldwork “in action” through digital technology among Ferris University students

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### Abstract.

"True learning is complete only when action has been put forth."  
- Xunzi, ca 313-238 BC

Our paper is an account on an inspiration coming from Filipino and Japanese approaches of remembering through hearing and seeing - *wido* in Filipino, learn and remember through hearing (Yamomo, 2018), and *kusyo* 空書 in Japanese, the motion of writing kanji in the air or on one's body to remember Japanese character (Sasaki, 1987). We argue that *wido* and *kusyo* fall within the realm of *karada de oboeru*, remember with your body (Megat Mohamed Noor, 2008:84). As culture bearers, we considered these approaches as experiential learning (Kolb, 1984) that could be employed to assist learners to reflect on their “experience” of doing something, through digital technology. In doing so, we succeeded in enabling students to see and hear fieldwork “in action” through the image of fieldwork in distance mode. The Zoom platform was used to beam socio-cultural and economic data from the field as it is impossible for students to be 100 % present in the classroom. Actual fieldwork among women divers (Zayas, 2016) in Goza, Shima City in Mie Prefecture was undertaken in January 2022 with the use of simple gadgets, e.g., cellphone, pc tablet, and pocket Wi-Fi, and key informant interviews. Towards the end, we assessed the successes of our online learning by asking students about what worked well and what didn't in their final essays. We have concluded that online learning can be used to simulate real conditions through *wido* and *kusyo* approaches.

**Keywords:** "karada de oboeru" framework, Fieldwork, Simple gadgets.

## A Scoping Review on The State-of-art Educational Data Mining and Learning Analytics in Prediction of Students' Learning Performance

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**Abstract.** Students' academic achievement is always a target of concern for educational institutions. Nowadays, the rapid development of digital transformation has resulted in huge amounts of data being generated by Learning Management Systems. The deployment of Educational Data Mining (EDM) and Learning Analytics (LA) emerged is becoming increasingly significant in discovering ways to improve students' learning outcomes. Those approaches effectively facilitate dealing with students' massive amounts of data. The purpose of this review is to evaluate and discuss the state-of-art EDM and LA for predicting students' learning performance among higher education institutions. A scoping review was conducted on eighteen (18) peer-reviewed publications that were indexed in ACM, IEEE Xplore, Science Direct and Scopus between 2012 and 2021. This study comprehensively reviewed the final inclusion literature on EDM in terms of tools, techniques, machine learning algorithms and application schemes. We have found that *WEKA* (tool) and *classification* (technique) were chosen in most of the selected studies carried out in their EDM/LA settings. This review suggested that Decision Tree as the supervised learning algorithm can better predict students' learning performance, as it has been validated in several comparative analyses in other algorithms. In the present study, we demonstrate a future trend toward developing a well-generalized automated prediction model that can work with a diverse population and can be easily used by educators in the general market.

**Keywords:** Educational Data Mining, Learning Analytics, Students' Learning Performance, Classification, EDM/LA Setting, Machine Learning Algorithm.

## Implementation and Evaluation of University Information Placement Test in Japan

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**Abstract.** This paper describes the Information Placement Test (hereafter IPT) and the Information Placement Test System (hereafter IPTS) for freshmen at universities in Japan. The purpose of the IPT is to measure knowledge and skills related to information technology learned in general education at the universities. The areas of informatics in general education are summaries in the General Education Body of Knowledge (GEBOK). Thus, the IPT and IPTS have been developed based on the GEBOK. The IPT was administered in 2018 and improved based on the results. Then the revised IPT was implemented in 2020. We analyzed the data and showed the results such as the percentage of correct answers. We show an overall trend in the percentage of correct answers and the areas with high and low correct rates.

**Keywords:** Information Placement Test, Body of Knowledge, General Information Education.

## Multiple Platform Problems in Online Teaching of Informatics in General Education Faced by Part-time Faculty Members

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**Abstract.** The curriculum for an undergraduate program in Japanese universities usually consists of a general education program and special/major education programs, and in general education programs, informatics is taught widely. It is one of the characteristics of the education of informatics in Japan. In a nationwide survey on the education of informatics in 2016, the teaching of informatics in general education depends largely on part-time faculty members as well as full-time ones.

Under the pandemic of COVID-19, most Japanese universities have been forced to have their teaching online in 2020 and 2021 A.Ys. Online teaching was carried out in several styles, using various LMSs and Video conferencing services and students' access terminals different by universities. Further, the permission of access to information systems depends on the renewal of the employment contract. In such a situation, part-time faculty members faced various problems of using multiple platforms rarely recognized by full-time members.

In this paper, the authors point out such multiple platform problems faced by part-time faculty members and propose a common platform for informatics in general education to solve the problems and to improve the quality of teaching.

**Keywords:** Informatics in General Education, Multiple Platforms, Online Teaching, Part-time Faculty Member, Identity Management, Educational Service Provision

## The tools which assist "creating questions through interaction with a computer"

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**Abstract.** We are currently developing teaching materials that emphasize "creating questions through interaction with a computer" and practicing them in university classes. We have developed a learning environment that supports each of the three phases of learning: deduction, induction, and hypothesis formation. We have developed learning environments to support each of these phases. In this presentation, we will introduce three tools. In this presentation, we introduce three tools: In-class Programming System, a programming environment for the deduction; In-class Note-taking & Sharing System, which supports learners' writing for the induction; and In-class Quizzing-Each-Other System for the hypothesis formation. Bit Arrow has a log collection and viewing function to store the learners' programming activities. The quiz creation system allows learners to submit questions to each other and evaluate the quiz based on the percentage of correct answers, and the In-class network service allows learners to write down their findings and share them with other learners.

**Keywords:** Creating Question, Interaction with Computer, Programming Education, Learning Environment.



## Comparison of Academic Impacts of Online Classes in the Real-time Setting with the On-demand Viewing Model

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**Abstract.** We gave the programming classes in the second semester of 2021 at an engineering college. These classes were held for first-year students in online settings. These classes were 100 minutes long. We taught Department of Environmental Engineering (28 students), Department of Electronics and Information Systems Engineering (59 students) and Department of Mechanical Engineering (36 students). The total number of students is 123. We delivered classes in real-time. However, we decided the policy that students could watch the recorded videos later and submit their assignments on-demand. We compare real-time and on-demand class types. Our methods seem to have two problems. 1) Teachers cannot force students to participate on time in class. 2) Unmotivated students choose to study on-demand and not study in the end. Such is not the case for our method, because students had to submit reaction papers and every homework assignment for a grade, so they never lost motivation. We gave four classes, three of which had a relatively large number of students who took the class in real-time, however the academic results were not so different. We think it is an excellent strategy for online classes. Ideally, students should be able to choose the class type that suits them best to enhance their learning effect, according to their learning environment and equipment.

**Keywords:** Online Class, Real-time, On-demand, Programming Education

## Visualizing Information Security Controls Using Virtual Reality Head-Mounted Displays

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**Abstract.** In the past few years, virtual reality (VR) has garnered both academic and industrial interests due to head-mounted devices' (HMD) enhanced immersive effects and their lower cost. VR's function to serve as storytelling with 3D experience makes them attractively promising for educational purposes.

In this study, we aim to study the impacts on effective learning by using virtual reality head-mounted displays. We propose to create VR computer lab modules to teach cybersecurity topics. We hypothesize that the learning of information assurance by visualizing information security controls through VR supported fully immersive experience is more effective than traditional classroom learning. We want to explore the capabilities of using HMDs to visualize information security controls, and conduct user studies to answer questions such as: Are HMD VR experiences more effective teaching information security theories and practices?

We propose to develop a VR application which will simulate scenarios for a user to gain access to a data center using two-factor door-access security measures. The virtual data center will be created by using a 3D camera to record a real computer data center. The access to the virtual data center is through a simulated door equipped with electronic card control and passcode access control. One scenario is for the user to present the electronic card and guess a correct passcode hence gaining access to the data center. Through this application, it is hypothesized that students will have a better understanding about the physical control measures in a data center.

We propose to develop a VR application for students to observe the public-key encryption and decryption processes in action using animated 3D illustrations. We are going to simulate the classic textbook illustrations of the application of encryption and non-repudiation in the communications between personas Alice and Bob. Through this application, it is hypothesized that students will have a better understanding of the complex public-key cryptosystems.

We propose to develop a 3D VR application to show how in the background that a response to a phishing email with a seemingly valid link will lead to sensitive data revealed to the attacker. In this case, the user's credentials are revealed to the attacker with the user being unaware of it. Through this application of vivid illustrations, it is hypothesized that students will have a better understanding of social engineering mechanisms.

**Keywords:** Virtual Reality, Gamification, Cybersecurity Education.

## Hands-on Training to Configure Communication Networks with GNS3 Web server for 40 Senior High School Students in a Class (Demonstration Included)

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**Abstract.** This session demonstrates the hands-on training to configure network routers and switches on a GNS3(Graphical Network Simulator – 3) Web server. About forty senior high school students in a class could have the hands-on training with their PC Web browser connecting to the teacher’s notebook PC which runs virtual Cisco routers and switches on the GNS3.

There are two types of textbooks for computer networks. One is an academic textbook such as “Computer Networking, A Top-Down Approach, Kurose & Ross, Pearson.” The other one is a textbook for network engineers such as “Cisco CCNA Basic Lectures for beginners, Gene, SB Creative.” Almost all the schools/universities in Japan select the former academic textbooks for network education, and the latter is scarcely used in ordinary schools/universities. Thereby, the students in Japan can explain the computer networking’s layered architecture, including some of the TCP/IP protocols. But most of the students do not understand the network itself. Because an academic textbook depicts the network as a white cloud which is a black box for students. Most students scarcely have a chance to configure network routers and switches.

To understand the network itself, students need to have hands-on experience in constructing networks. However, it has been almost impossible to prepare the network training environment at schools. GNS3 makes it possible for each student to have hands-on experience of network construction in a class. This session demonstrates the system with the actual GNS3 server we used for the class. We confirmed that only one A4 size notebook PC (Lenovo ThinkPad P14s AMD4750u) was enough as a server for a small network configuration training for about 40 students. The network OS we set in GNS3 was true Cisco OS. If the same commands are applied to the real Cisco routers and switches, they work.

In the class, some students could not “ping” through to the destination initially, so they fixed their router configurations one by one. Finally, all students in the class completed their networks successfully. (The “ping” is a network command to confirm the logical connection between network nodes.)

It was our surprise that this hands-on experience helped the same students in a programming class. They could easily understand python client/server programming and could communicate with each other over a real router.

**Keywords:** GNS3, Web, Network, Hands-on learning, Network Simulator.

## Effective Case Studies of Supporting Class by Engineers in Company at Tokyo P-TECH

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**Abstract.** Tokyo P-TECH is a new educational model to develop IT talents through school and company partnerships. For its preparation, we conducted supporting classes for specialized subjects, e.g., network technology and C programming, in the pilot period for two years in FY 2019 and FY 2020.

Even though students had learned about IT at technical high school, there were not a few students who worked in industries other than IT. To overcome the situation, we set the objectives of these classes are increasing the students' motivation for learning and interest in IT and convey the importance of continuous learning. We accumulated effective case studies on how engineers in companies can provide their skills and knowledge to students to develop IT talents. This poster shows the following three particularly effective case studies.

*Role-play and Shadowing at Network Troubleshooting:* Through role-play and shadowing, the students could consider the problem as their matter and learn how real engineers think and deal with the problem. The NSI (Net Satisfaction Index) for the on-site class in October 2019 was 84.7 (N=32). The NSI for the remote class in November 2020 was 74.3 (N=34).

*Improvement of a Sense of Presence at Remote Classroom:* We conducted all the presentations in MURAL, a digital canvas on the web, in the class to learn about Cloud Technologies in March 2021. It enables each student to move their avatar and follow a tour guide around to listen to stories and see places as they pleased, and their sense of participation in the class improved. The NSI for the March 2021 remote class was 84.6 (N=34), almost the same as the 85 (N=32) for the February 2020 on-site class.

*Mob Programming Approach at Programming Class:* We formed teams of three or four students, and one engineer per team was remotely assigned as a coach. The team used one computer and tried to solve bugs through a team discussion. Since students exchanged their thoughts with each other, the engineers could understand their pain points quickly and easily. In addition, some students started coaching other students who didn't understand well, which promoted exemplary behavior required of engineers. The NSI for the November 2020 remote class was 86 (N=34), close to 87 (N=32) for the September 2019 on-site class.

We concluded that high NSIs and positive comments from the students indicate that these case studies were effective.

**Keywords:** P-TECH, Engineer, Remote Class, Network Technology, Mob Programming



## Analysis of Learning Patterns and Final Grades in an Online University and a Study of Appropriate Intervention Methods for Students

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**Abstract.** In online learning, dropout is often cited as a reason for learners' inability to continue learning. This study examined how best to intervene by analyzing the relationship between online learners' learning history and their final grades. The results showed that completing the first class earlier may have a greater impact on final grades. This revealed the possibility that it may be better to send encouraging messages to students who are behind in their studies a little earlier than in the traditional way, in the first half of the entire study period, about one week into the study period.

**Keywords:** learning history, online university, dropout reduction.



## Development of a coding skill training system using "Clone coding"

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**Abstract.** It is not always the case that students who have mastered the basic grammar through such education have acquired enough programming skills to be able to program on their own. In our experience, many students can modify the sample programs used in the class, but cannot code from scratch.

Some students have never written a program on their own until they graduate from university. This indicates that the students cannot utilize what they have been learning. We consider that one of the reasons is that students are not voluntarily coding.

In this presentation, we describe a training system for improving coding skills that we are developing intending to enable learners who have learned the basics of programming to gain a variety of experiences and new insights through spontaneous coding. However, it is not easy for students who have learned the basics to code on their initiative. Unless they are in a special situation where they are required to program, they will not be able to figure out what kind of programming they should do and assign themselves to do it.

Only when the student has a clear objective can we expect the student to act spontaneously. It is one way for a teacher to show students a variety of coding tasks. However, it is a great burden for teachers to come up with tasks that will keep the students motivated.

We have begun to develop a coding learning environment to provide these students with specific objectives so that they can proceed with their learning spontaneously. The most important feature of our system is the use of "clone coding". In this research, "clone coding" means to create something that imitates the appearance of an existing application or web page. We think that by using the applications and web pages that students usually use as models, we can keep them motivated. Moreover, we expect that the student will gain a high sense of accomplishment by imitating the appearance of the application.

We are currently developing a learning environment focusing on the Web page cloning coding, which will be presented.

**Keywords:** Clone coding, Coding skill, Programming education

## Using Machine Learning to Analyze Keystroke Dynamics for Programming Proficiency

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**Abstract.** Typing on a keyboard is a very fundamental skill in the era of digital society, even though various kinds of multimodal digital devices appears. This study has addressed the analysis of keystroke dynamics in order to measure IT and programming proficiency. To begin with, we have assumed that a student who often write programs is characterized by faster typing especially for code-specific notations. Based on this assumption, we have collected keystroke data from more than 100 students. We classified these students into 2 to 4 classes according to their programming ability based on their learning records from online judge system such as AtCoder. We used the collected data and class labels as training data to build a classification model. The classification models we have tested include Random Forest and Transformer, an efficient deep learning model for serial data. We report on the prototype classifiers and their prediction accuracy and demonstrate a possible estimation of programming proficiency from students' keystroke dynamics.

**Keywords:** keystroke dynamics, machine learning, programming proficiency

## Implementation and Teaching Plan of Spreadsheet Application for Basic Education of Artificial Intelligence

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**Abstract.** In recent years, learning literacies for artificial intelligence is one of the most important subjects for first-year students in Japanese universities. Especially, basic knowledge of data-driven decision makings is essential for them. Using computer programming with text coding steps is the most effective means to learn it. However, many of the first-year students not interested in computer science or data science fields do not have enough programming skills. Many Japanese universities provide classes to learn spreadsheet software for their first-year students. Most of the software products allow the students to analyze datasets easily, and the teachers of the classes to provide applications working on the software. Therefore, for the students before obtaining the programming skills, the software will work as an alternative to the text coding. The application presented here is a set of handouts and a macro-enabled workbook of Microsoft Excel. The workbook provides special cell-functions of a theory of discriminant analyses which estimates a good boundary between two classes in a dataset. The handouts to learn the theory of the method provide exercises using histogram graphs. After the learning, the students will acquire experiences of image processing using the theory. The macro loads pixels of a small digital image on the cells of a sheet named Color. The RGB-channel values in the cells are also presented in cells of sheets named Red, Green, and Blue. Each of the cells presents the pixel color by visual interior painting and a numeric cell value. The presentations will help the students to understand the data structure of bitmap images and digital expression methods of visual information.

After the loading process, the application provides experiences of image-extract processing using simple formulae and conditional branches. The students will design the formulae and input them in the cells of the last sheet. For example, subtraction formulae of Blue-Green or Blue-Red may extract blue sky pixels from landscape digital images. Finally, the macro using the discriminant analyses, conditional branches and the formulae draws the extracted partial images on the last sheet. The experiences will help the students to understand relationships between mathematical theories and information processing.

This work was supported by JSPS KAKENHI Grant Number 18H03597, 18H05221, 18K00972, 20H00022, and J. F. Oberlin University Research Fund for On-campus Scientific Promotion. The application will be used and evaluated in the classes of the university with 300-400 students. Images of landscapes, cultural properties, and others will be applied for the learning.

**Keywords:** artificial intelligence, AI literacy, spreadsheet application.

## The Cyberethics Grade Comformation System for Shibboleth Federated LMS

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**Abstract.** Information security training is now mandatory for all university members. To support such universities, the National Institute of Informatics has developed a collection of sample regulations for information security measures in higher education institutions, as well as providing e-learning materials that can be commonly used in each institution. These materials are provided on the GakuNin LMS and can be used by universities participating in the GakuNin, a Japanese academic federation, by Shibboleth authentication.

In the Gunma University, students are required to take this e-learning course, and this is achieved by making it a credit requirement for the compulsory first-year course. We also only allow the use of VPN connectivity and eduroam services to those who have completed the course. In this way, we encourage our faculties and staffs to take this course. In achieving this operation, several problems arose caused by the inter-university sharing of the LMS. We overcame this problem by using the Cyberethics Grade Confirmation System (CEGC) developed by the authors and operational changes to GakuNinLMS.

The first problem is how to protect the users' privacy in the shared LMS. When the shared LMS started operating at the NII, user IDs were anonymized by eduPersonTargetedID (ePTID) attribute. However, it was difficult to identify the user ID from the ePTID. To solve this problem, we have developed CEGC, which works with the IdP and identify user ID from ePTID. As both GakuNinLMS and CEGC are Shibboleth SPs, we also considered the implementation of forming a virtual organisation between them and issuing a common anonymous ID to both SPs via IdP. However, as such an operation is complicated in the current situation, we are finally decided to use eppn instead of ePTID.

The next problem is that the GakuNinLMS cannot provide grade information limited to teachers' classes. This problem was solved by using GEGC to allow each teacher to view grades only for students in the classes for which they are responsible by importing class data from SIS.

Finally, the manual linkage of grades and course history is a remaining problem. We are planning to implement an API for obtaining grades and course histories in the GakuNinLMS to support automatic linkage in the near future.

**Keywords:** GakuNinLMS, Shibboleth, Inter-institutional Sharing of LMS



## An AI-based Chatbot for Programming Education on the Colaboratory

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**Abstract.** In the era of digital society, programming is becoming an essential skill for everyone. Programming education is broadly introduced into primary, junior, and senior high schools. However, the shortage of eligible teachers is a big challenge; many students are stuck due to small mistakes and errors without any appropriate assistance.

To overcome the shortage of teachers in primary, junior, and high school, we have developed Kogi, an AI-based chatbot for teaching assistance. Kogi support student by providing natural language code suggestion and dialog-based error causes analysis when errors occur. These assistances have been built on a transformer-based text/code generation AI model, and an extended conversational interaction is integrated into the Google Colaboratory.

In this presentation, we will demonstrate the development status of Kogi with our earlier experience reports in the classrooms.

**Keywords:** Chatbot, Machine Translation, Programming Education.



# Session 14A

## Designing Digital Credentials for Validating IT skills --a case for i-Competency Dictionary --

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**Abstract.** Around the globe, applications of open standards in digital credentials such as Open Badges and CLRs have made ways for validating skills/competencies earned by learners. This paper aims to examine the enablers for recognizing skills aligned in digital credentials in the case of IT professionals, by drawing characteristics of skill frameworks in Japan and Europe, and reviewing industry-academia cooperation efforts for talent pipeline in the US, and suggest using the i-Competency Dictionary (iCD) as a common ontology for digital credentials in IT skills.

**Keywords:** Open Badges, Competency-Based Education, Interoperable Learning Records.

## Zanzibar Declaration Panel on ‘Sustainable Education in a Digital Age of rapidly Emerging Technologies’

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**Abstract.** IFIP Technical Committee 3 (TC3) agreed in its Annual General Meeting in April 2019, held in Zanzibar, Tanzania, to initiate development of a declaration on ‘Sustainable Education in a Digital Age of rapidly Emerging Technologies’. This ‘Zanzibar Declaration’ (ZD) focuses on future educational challenges that arise from rapidly emerging technologies impacting societies and communities and is closely related to the UN’s Sustainable Development Goal 4 (SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all).

A matrix was initially developed, which defined various emerging IT technologies positioned against social areas in which these technologies are applied. In four webinars in 2021, experts from different disciplines and from across TCs of the IFIP covering four thematic clusters of IT technologies and social impact areas. Details of that part of the ZD process, outcomes of the four webinars and the ZD grid can be found on the ZD website: <https://zanzibardeclaration.cicei.org>.

The WCCE 2022 online panel will be the final stage of gathering expert contributions, on the remaining key topics of the matrix: Computer Networks and Communication and Mobility; Recognition (Tracking) and Enduring Information and Quality of Information; Robotics and Decent Work; Virtual and Augmented Reality; Cloud Computing, Privacy and Social Surveillance; 3D/4D Printing and Energy; and Humanoids and Digital Equity. Still to be confirmed, seven short expert presentations are planned, offering expert views on the current situation in each topic, and likely future issues and challenges. Following this panel session, where participants are encouraged to provide their responses, a draft ZD will be developed, and circulated for comment through a consultation process, prior to international release.

**Keywords:** Sustainability, Emerging Digital Technologies, Social and Educational Implications.

## Universities of the Future and Industrial Revolution 4.0: The Academy Transformation

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**Abstract.** This article aims to reflect on the changes that are taking place today (considering them from different perspectives), as well as to describe the impact that results from these changes in social, economic, ethical, and academic terms, and the role of creative learning in this transformational process. A description is made of the main characteristics of this moment, mainly in what is considered the industrial 4.0 revolution, as well as the main global trends that are associated with it in this third decade of the millennium. Presenting the Universities of the Future (UoF) project, an assessment of its main results is made, as well as essential questions that must be asked so that decision-makers, in different “stages of power”, can consider as valid in building a different and better future for the planet we inhabit. Part of the answers found seem to suggest that the different social institutions must converge in a collaborative paradigm, in which the free sharing of knowledge, the distribution of resources, the focus on common problems with different approaches and by different players, bring more creative, efficient, and sustainable solutions and knowledge.

**Keywords:** Industry 4.0, I4.0, Universities of Future, Creative Learning.

## Instructional Methodologies for Lifelong Learning Applied to a Sage Pastel First-year Module

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**Abstract.** Lifelong learning is a useful and beneficial skill to learn. In this paper, students from a university in South Africa are taught Sage Pastel in their first-year of study using the Instructional Methodologies Framework for Lifelong Learning. This framework includes problem-based learning, e-learning, reciprocal teaching, professional portfolios, reflections, and knowledge maps. The students were asked how they experienced the module and their responses were mapped to the framework to demonstrate their journey. It is concluded that the majority of the students found the approach useful as a lifelong learning skill, with an 85% positivity indicator. The teaching environment used for this paper is unique, as the data was gathered in 2021 when the university was teaching only online because of Covid-19 restrictions, but the benefits of following a lifelong learning approach are evident. Future research will include comparing this module to other first-year modules that follow a similar approach to determine if students do become life-long learners.

**Keywords:** Lifelong Learning, Sage Pastel, Instructional Methodologies, Learning Management System, Sustainable Development Goals.

## Indicators of Pedagogical Factors Influencing Learning Outcomes in Informal Educational Mobile Apps

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**Abstract.** The educational mobile apps enjoy increasing popularity, in formal (such as classrooms) and in informal settings (outside the classroom). The factors behind the usefulness of informal educational mobile apps in the learning process have not been firmly established. Possible pedagogical factors influencing learning outcomes in traditional teaching context have been researched by several researchers. Many of those pedagogical factors can also be used in the development of mobile learning apps, such as: engaging students, structuring the material, scaffolding type used (when questioning students), critical thinking development, opportunity to practice/apply learned knowledge and overall pedagogical approach used (game-based learning, drill and practice, inquiry based learning, collaborative learning, flipped classroom, mapped trail/self-regulated learning, mixed). Current work in progress aimed to analyze how user experience factors (perceived entertainment, motivation to use, agency and usability) of the informal educational mobile apps are associated with described pedagogical factors that influence learning outcomes. Method: user experience (UX) data was collected with two questionnaires (Subjective Metrics with User Experiments and System Usability Scale) filled in by users pre- and post use. Pedagogical indicators were coded by two experts (university lecturers) using the scale 0-not present, 1-somewhat, 2-yes, used. Users (N=1152, age 8-19 years) free format answer about experience was used to code added value to the learning process. UX data of Citynomadi, Fillarilla, Rescue Busters, Word Dive and Action Track Zone apps was collected. The descriptive analysis enabled insight into how pedagogical summative and individual factor scores were associated with the user experience. Examples of some results: three pedagogical approaches were used- mapped trails with tasks (2), drill and practice (2) and game-based learning (1). Game-based learning of first aid received the highest UX scores and high pedagogical factors scores. Drill and practice app for cycling safety was pedagogically best developed, with good UX scores. Mapped trails obtained lowest pedagogical and UX scores. Motivation to use the app always declined post use compared to pre-use, largest decline appeared with game-based app. The indicators used are suitable for a more general framework that unites UX factors important for app designers and pedagogical indicators that influence learning outcomes.

**Keywords:** Educational Mobile Application, Pedagogical Factors, Learning Outcomes, User Experience Data, Informal Learning Applications.



## Predictive Evaluation of Artificial Intelligence Functionalities of Software: a Study of Apps for Children's Learning of English Pronunciation

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**Abstract.** This paper is based on a study that developed and used a predictive evaluation method to evaluate educational software with embedded Artificial Intelligence (AI) functionalities for children's learning of English pronunciation. The approach built on Squires and Preece's heuristics which used a social constructivist view of learning but were developed before AI functionality was commonplace in educational software. Three AI-powered English learning apps were selected for the predictive evaluation. These apps are widely used in China and designed for young Chinese learners of English as a second language (ESL). The evaluation enabled a comparison between the AI-powered English-learning apps based on their potential for learning. The study is the first to predictively evaluate pedagogical values of AI functionalities for improving ESL pronunciation and may provide an approach to developing predictive evaluation more widely for educational software that embeds AI functionality.

**Keywords:** AI Functionalities, Software Evaluation, Predictive Evaluation, English Learning, English Pronunciation.

## A Workshop of a Digital *Kamishibai* System for Children and Analysis of Children's Works

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**Abstract.** The authors have developed a digital *kamishibai* system, for authoring and performing *kamishibai* is said to have good educational effects on children. The system is implemented so that even children can operate it easily. The characteristics of the system are authoring with drag-and-drop operation and performance with ad-lib animation. Through the experiment, the authors made sure that children over six years old could handle the system. In this paper, the authors carried out a workshop in which children authored and performed digital *kamishibai*. Forty-eight groups participated. From the questionnaire, both children and their parents were mostly favorable to the system. The effects mentioned above were observed. Through the workshop, various *kamishibai* works were made. The authors showed these works to a staff of a children's hall (an expert of *kamishibai*) and had review them. He pointed out children's comprehension of stories, characteristics and style of representation, and structures and originality of the works. One of the future works is a detailed analysis of the works.

**Keywords:** Picture Story, Kamishibai, Storytelling.

## **Digital Technologies for Learning, Teaching and Assessment: Tackling the perennial problem of policy and practice**

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**Abstract.** Education policy implementation is a complex, evolving process that involves many stakeholders often with seemingly conflicting and opposing visions. This paper presents an account of work in progress in which the authors are conducting an analysis of the enactment of a strategy for digital learning in schools in Ireland. The aim of the study is both to analyse and theorise the extent to which the policy has achieved its aims but also to identify a means of tackling the perennial challenge of policy development and enactment at the school and classroom level. This paper presents the findings of the first phase of analysis.

**Keywords:** Policy, Practice, Digital Technologies for Learning.

## Proposal of prevention simulation game using VR: Disaster prevention education from “boring” to “fun”

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**Abstract.** As an island nation in the Pacific Ocean, Japan is prone to disasters such as earthquakes, tsunamis, and typhoons, in addition to having many plates. The Great East Japan Earthquake, the Kumamoto Earthquake, and the mudslide in Atami are still fresh in our memories, and unpredictable disasters can happen anytime. Therefore, for many years, school education has provided disaster prevention education to cope with disasters. However, the drills we have experienced have been tedious, such as simply hiding under desks or evacuating to the schoolyard as quickly as possible to escape personal danger. As a result, the evacuation drills have not been realistic or interesting, and the importance of daily drills and information gathering has waned as we have grown older. Since lifesaving education needs to be enhanced through daily drills, changing the image of disaster prevention from "boring" to "fun" is essential. With the development of the information society, various technologies (such as simulations or VR) have become more accessible. Hazard maps are digitalized and visualized the damage caused by disasters and are easily accessible to everyone. We propose to extend this hazard map data and the already utilized VR game content to propose a more realistic and serious game with virtual and simulation elements for the masses. By entering the metaverse, the user can have a realistic experience, and the fact that the game is a game will attract interest in disaster prevention. Developing a new game may present many difficulties regarding cost, time, and developers. However, we propose (1) to make good use of existing content and (2) to bring together the government, citizens, and companies to utilize their respective knowledge.

**Keywords:** Disaster prevention education, Data Utilization, Metaverse.

## A Feasibility Study on Learning of Object-Oriented Programming based on Fairy Tales

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**Abstract.** In learning of object-oriented programming (OOP), it is necessary to understand the concept of OOP and apply it to actual development. However, acquiring such skills is not easy for novice programmers. We propose a learning method based on fairy tales in order to make it easier for learners to work by assuming a specific situation, and to make it easier for other learners to share the situation. In the proposed method, the learner selects one fairy tale as the subject his/herself and expresses the flow of the story by interaction between characters, changing attributes, exchanging objects, and outputting narrations. Finally, the learners design the classes and methods necessary for expressing them and implement as an executable program. We applied the proposed method in a lecture at the graduate school and confirmed the feasibility.

**Keywords:** Object-Oriented Programming (OOP), Software Analysis and Design, Software Engineering.



# Session 14E

## AI Ethics with Emphasis on Philosophy and History of Science

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**Abstract.** Considering artificial intelligence (AI) to be "advanced science and technology for information and knowledge," AI ethics overlaps ethics of advanced science and technology in general. Most graduate students in their early stage of graduate study have little experiences either in ethics, legal and societal issues (ELSI) or methodology of science to need introductory explanations in the both fields in the first month of the course of ethics of advanced science and technology. The research area of AI is essentially elusive; so are the contents of any AI ethics course. Assignments should be flexible even during a semester, since the societal situations may quickly shift.

**Keywords:** AI Ethics, Higher Education, Methodology of Science.

## Gender-Inclusive Learning Materials for Programming Focused on Data Visualization

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**Abstract.** This study introduces learning materials for introductory computer programming from the viewpoint of gender-inclusion. Although information technology educational opportunities are considered as gender-inclusive matters, men still make up a large percentage of the people working in IT-related occupations. Despite there being no evidence that gender differences in information/mathematical competence exist, such a situation remains. Corneliussen and Tveranger pointed out that the lack of an inclusion strategy in schools reinforced the imbalance of social gender structure in the IT field.

On the basis of such a situation, we have considered the approach of gender-inclusive programming education. Several studies report that girls prefer computer programming that incorporate storytelling, visual/creative exercises, and problem-based projects. We have focused on data visualization to develop learning materials to attract female students to learning programming more. All learners have data that they are interested in, no matter what field they study. Finding data and expressing it in an informative way using programming would induce motivation in students studying computer programming in various majors, and then reduce the gender-gap in the IT field as a result.

We have been developing learning materials for introductory programming using JavaScript and p5.js. It consists of three parts; (1) basic programming exercises focused on drawing primitive graphics, (2) libraries for sophisticated visualization that can be used by beginners, (3) sample programs using our libraries to express public or original data visually. The libraries provide functions for reading external files, parsing data, normalizing, simulating physical motion and linking the motion objects with data. These aim for students to implement program for data visualization without load difficulties, and to concentrate on the parts they are interested in.

We have applied our materials in an introductory programming course in a university and received students' feedback. We will present the concept and the functions of the libraries and the sample programs, and the practice in a class.

**Keywords:** Introductory computer programming, Gender-inclusion, Data visualization.

## Curriculum Standard of Informatics in General Education at Universities in Japan

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**Abstract.** Most universities in Japan provide informatics subject in general education for all faculties. For the students except majoring in computing discipline, this subject is the last chance to learn informatics in a systematic way succeeding from K-12. However, its content and level vary largely in universities because of the wide range of informatics. The Information Processing Society of Japan, IPSJ, has developed the computing curriculum standard called “J17.” Although the name implies, J17 focuses on the education for computing major, it also includes the body of knowledge of informatics subject in general education which we call GEBOK. In this paper we will review GEBOK, then present an example of the implementation as a classroom practice. Future issues of the computing curriculum standards will also be discussed.

**Keywords:** Computing Curriculum, Informatics in General Education, Body of Knowledge.

## Changes in Attitude towards Mobile App Development: a Preliminary Comparison between MIT App Inventor and Android Studio

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**Abstract.** In this work-in-progress study, we compare the effect of different programming environments on students' attitude towards mobile app development in an Android development course. This course taught Android Studio (a textual programming environment) in 2020 and MIT App Inventor (a visual programming environment) in 2021. We administered an original mobile app development attitudes survey at the beginning and the end of the course in each wave. The questionnaire constitutes 39 items that fall into 8 dimensions: confidence, motivation, gender, usefulness, knowledge, learning style, self-reliance, and context. All items are answered on a 5-point Likert scale ranging from "strongly disagree" (=1) to "strongly agree" (=5). Some items require reverse scoring (i.e., 6 subtracts the score) when calculating the score of each construct and the total score. The range of the total score is 39-195 and a higher score indicates more positive attitudes towards app development. Respondents can skip an item if the statement is not well-understood to ensure that a response of "neutral" truly indicates no opinion. The questionnaire was originally developed in English and was translated to Japanese by a native Japanese speaker. Both the English version and the Japanese version were made available to students, and they could answer the questionnaire in their preferred language. The responses in both languages were merged in the final dataset. It was made clear to students that survey completion was voluntary and was not in any way related to their final grades. We used Mann-Whitney U test to examine whether there was statistically significant difference in students' baseline attitudes in the two academic years and found no statistically significant difference except in the knowledge construct ( $W = 606.5$ ,  $p = 0.029$ ). The cohort in 2021 ( $20.9 \pm 1.4$ ) scored slightly lower in the knowledge construct than the cohort in 2020 ( $22.6 \pm 2.7$ ). Given the small sample size especially at the end of the 2021 semester, no statistical test was performed. Alternatively, we utilized boxplots to visually inspect any potential before-after change in students' attitudes. The preliminary results showed that compared to the Android Studio group, the MIT App Inventor group were self-perceived with higher level of confidence and self-reliance and had better ability to contextualize app development after completing the course.

**Keywords:** App Development, Attitudes, Visual Programming, MIT App Inventor, Android Studio.

## Generalization in Programming Classes

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**Abstract.** Generalization – as a facet of computational thinking – is the skill to create a software solution in a way that it can be reused in other programming projects. Basic techniques to improve the reusability of a class include overloading familiar operators (like addition), supporting type casting and providing printable representations of objects that are helpful for debugging. Generalizing is also related to specific techniques of software reuse like calling a function on different levels of generality, adapting a problem to make reuse of an already known solution possible, learning by experimenting in an REPL environment, tracing and debugging. Creative coding activities may encourage learners to use functions and classes for designing art. Frequent reuse in different contexts is important to raise awareness of the generality of a programming concept. This contribution presents classroom activities that focus on generalization in three different ways: Exploring generality, increasing generality, and creating generality. Generalization by creating reusable software requires high level programming skills beyond algorithm design. Since future reuse is anticipated such project requires experience, time, and personal engagement. A possible way to encourage learners to develop a piece of software and then use it extensively, is a “creative coding” project with the goal of creating digital art.

**Keywords:** Computational Thinking, Generalization, Programming.



## The Impact of Tolerance for Ambiguity on Algorithmic Problem Solving in Computer Science Lessons

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**Abstract.** In computer science lessons, situations can arise which the learners can perceive to be subjectively ambivalent, such as algorithmic problem solving. Tolerance to this individually perceived ambiguity is an internal factor that can influence the absorption and processing of knowledge both positively and negatively. Thus, it was examined whether there is a connection between tolerance for ambiguity and the performance of students in an ambivalent task for algorithmic problem solving in computer science lessons. The results show that there is a significant correlation between tolerance for ambiguity and the number of points achieved in the test for algorithmic problem solving.

**Keywords:** Tolerance for Ambiguity, Algorithmic Problem Solving, Quantitative research, Computer Science Lessons, Upper Secondary Education.

## Introducing AI Literacy in Schools: A Review of Pedagogical Approaches, Formats, Competence Areas, Evaluation Methods, and Inclusion of Data Literacy

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**Abstract.** Introducing artificial intelligence (AI) literacy to school students is a challenging task. As the field of AI education is constantly growing, educators can struggle to decide *what* content is relevant and *how* it can be taught. To facilitate these tasks and encourage the development of new activities, it is necessary to examine which practices and formats have already been evaluated with students and are used repeatedly, and which are challenging or should be explored further. In the following literature review, we address this need. Using a mixed-methods research design, we systematically analyzed 31 case studies that introduced AI literacy in schools in terms of five categories: (1) competence areas, (2) pedagogical approaches, (3) formats and tools, (4) evaluation methods, and (5) inclusion of data literacy. In analyzing the results, we identified underrepresented competence areas and summarized common pedagogical practices, recurrent formats, contexts, and evaluation methods. Additionally, we investigated the approach to using data to make abstract AI knowledge accessible to novices.

**Keywords:** AI literacy, AI education, data literacy.

## Literacy from Python 2

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**Abstract.** This paper presents the classroom development of a secondary school computer coding project, Literacy from Python. The aim of the project is to contextualise the teaching of Python through a cross-curricular teaching and learning model. It therefore recommends the development of introductory coding skills by students, aged from about 10 to 14 years, through the creation of very short stories or scripts, using Python strings. Each story by the two pilot groups of Year 8 students, aged 12 to 13, presented here, includes examples of additional Python programming elements, such as Turtle Graphics, sleep functions, inputs and if statements, within the constructionist framework of a creative writing project. The students were given free range to explore examples of Python coding on the internet, and to use, adapt, or repurpose the material that they discovered, as part of the National Curriculum in England. The two pilot groups of 30 students developed their own original short stories, and were encouraged to develop Python coding elements through exploration and experiment, rather than the detailed guidance of their teacher. They worked independently.

**Key words:** narrative work, creativity, Python, Turtle Graphics

## How Elementary School Students Experienced Algorithms: Using Sorting Algorithms Online Learning Tool

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**Abstract.** In this research, we explore how elementary school students experienced the importance of algorithms with our proposed sorting algorithm online learning tool. The sorting algorithm is an essential topic in computer science, and it is an often-utilized topic to experience the difference in efficiency among algorithms. However, understanding sorting algorithms is challenging because students need to understand complex procedures based on various layers of abstraction. Especially, it would be hard for elementary school students who are just starting to get a programming education. To address these issues, we proposed an interactive online learning tool to learn sorting algorithms for novice learners (<https://pro-ktmr.github.io/learn-sorting-algorithms-wcce2022/>). The proposed tool has hands-on exercise and animation functions with the bubble sort and selection sort algorithms. The tool allows students to learn algorithms interactively as though it were a game. In addition, it has some new ingenuities of practice and visualization for naturally fostering an understanding of algorithms. For instance, the tool limits the number of cards that can be turned over at once to at most two in order to express a restriction on computers. Furthermore, the automatic judgment mode points out students' wrong operations, which allows students to learn independently. We also developed remote teaching support features, including a remote view function for supporting online/HyFlex courses. In this study, we conducted an empirical evaluation at a Japanese elementary school to evaluate the tool. Students and assistant teachers gathered in a classroom, and a teacher in charge attended the class remotely using a remote conference system and the remote view function of the proposed tool. During the class, students could achieve executing algorithms on the tool. After completing all the lessons, we surveyed how elementary school students learned and experienced the importance of algorithms with our proposed sorting algorithm learning tool. Our findings show the proposed tools' potential to encourage understanding algorithms' procedures and executing them on one's own.

**Keywords:** Sorting algorithms, Elementary school education, Experiential learning.

## **What is the consequence of getting a greater sense of empowerment? – longitudinal cohort study of early programming education in Japan during the '80s and '90s –**

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**Abstract.** The objective of this paper is to know the consequence of Totsuka's practice. In the '80s, a terrific teacher developed his original version of Japanese LOGO by himself and tried it in a small elementary school in a rural area as "Totsuka's Practice". He used LOGO programming as a tool for empowerment of children's scientific research and making mathematical understandings. We have conducted a longitudinal cohort study over 30 years of Totsuka's practice. The longitudinal cohort study suggested that 91 people from 250 who taught by Totsuka showed the different disposition of university enrollment and advanced professions of their work from general people. Further, the interview study for two people suggested that computational thinking derived from Totsuka's practice is living in their minds, and computers worked as an amplifier for empowering themselves.

**Keywords:** Totsuka's practice, longitudinal study, interview, LOGO.



## Symbiotic Approach of Mathematical and Computational Thinking

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**Abstract.** Although CT is a rapidly expanding field of educational research, it is a relatively new concept in national curricula. From the curriculum policy perspective, two subjects taught in primary and secondary schools look the best candidates to address CT: computer science/informatics and mathematics. As informatics does not exist as a separate subject in many national curricula, mathematics becomes „the next best“ alternative for integrating CT in the curriculum. Our analysis shows that there are three major scenarios how CT has been introduced in the national curricula recently: (A) as a part of the informatics curriculum, (B) as a part of mathematics curriculum and (C) undefined by national curriculum, but encouraged to be integrated in various subjects (mostly STEM). This paper gives an overview of computational and mathematical thinking and stresses the overlap between those two concepts. Examples of different ways of integrating CT in K-12 education is illustrated by examples of three neighbouring countries: Finland, Estonia and Lithuania.

**Keywords:** Computational Thinking, Mathematical Thinking, Informatics Curriculum.

## Implications for Computer Science Curricula in Primary School: A Comparative Study of Sequences in England, South Korea, and New Zealand

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**Abstract.** The purpose of this study is to gain implications for the design of computer science curricula in primary school in Japan through the analysis of K–12 computer science curriculum sequences in England, South Korea, and New Zealand. This study focuses on the progression of key areas of computer science learning in K–12 education. This study identified trends in the sequence of computer science concepts and practices in K–12 education in the three countries. The trends were classified into three categories: (1) learning the concept itself is limited below Grade 6 and learning related to advanced concepts becomes extensive above Grade 7, (2) learning about the concepts becomes progressively more advanced and extensive throughout K–12 education, and (3) learning about the concepts becomes more advanced in scope and complexity throughout K–12 education as the context in which concepts are applied becomes more advanced. These implications can be applied to K–12 computer science curriculum design in Japan and also in other countries around the world.

**Keywords:** Computer science education, Curricula, K–12 education.

## Comparison of Causality-Influenced Logic Misreading by Nationality, Education, Occupation, and Gender

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**Abstract.** Science, technology, engineering, and mathematics (STEM) education, including programming, has become an important policy component as the world is rapidly changing with information technology. In Japan, one of the key objectives of STEM education is to strengthen logical thinking skills. It is believed that learners' ability to think logically depends on a variety of factors, including nationality, educational background, occupation, and gender. In our previous study in Japan, we reported that logic misreading often occurs commonly among all subject groups and is strongly influenced by the direction of causality. In other words, we found that the frequency of logic misreading was significantly higher for reverse-order sentences, in which past causes are inferred from the current situation, than for forward-order sentences, in which future results are inferred from the current situation. We also noted that the percentage of correct answers could be an indicator for assessing logical thinking ability. In this paper, we expanded the survey target from Japanese nationals to other countries and assessed the ability to read the basic argument structure, which represents the relationship between a claim and a basis, of subjects belonging to various groups. The results indicated that a significant percentage of adults, regardless of nationality, fell into logic misreading influenced by the direction of causality. The results also revealed that subjects' misreading tendencies differed from widely known stereotypes based on nationality, occupation, and gender.

**Keywords:** STEM education, critical thinking, logical thinking, argument model, stereotype threat.

## A Social Media Simulator for Media Literacy Education in Japanese schools and universities

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**Abstract.** Social media services (SNS) are both a means of communication and an essential tool for gathering information.

Although the importance of media literacy education is constantly increasing, literacy regarding behaviour on social media is currently not reflected in relevant curricula. This paper presents the design process and research findings of an online educational tool 'To Share or Not to Share' that simulates social media services.

The tool provides a social networking learning experience in a formal educational setting. Through this experience, learners evaluate real social media posts and make decisions to share or not share information, thus gaining or losing followers. Learners can access other players' statistics and analyse reference information, such as expert opinions, to support their decision-making. The learning effects of introducing this tool to university, high school and secondary school students are reported in terms of changes in their ability to make decisions about social networking posts at different ages, as well as their attitudes towards social networking.

We believe that media literacy education is as much about attitude formation as it is about competency, along with knowledge and skills.

By using simulations, we are examining the possibilities of constructivist learning for the formation of learners' attitudes, rather than just expository classroom teaching.

We see SNS as a global medium, but as a conversational form of communication. This time we experimented with Japanese SNS articles for Japanese students. In the future, we would like to conduct experiments with articles from other countries and with students from other countries, in order to examine the differences in culture and learning.

**Keywords:** Media Literacy, Fake News, Social Media, Serious Games.

## A Practice of Game Exercises in Information Security Education

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**Abstract.** The author's university has elective classes on the basics of information security in the liberal arts education program. The purpose of these classes is to provide students with an understanding of the concept of information security and the strategies for its countermeasures, which are necessary in their university studies and daily lives. In this paper, the author reports on the practice of one such class, in which a game-based exercise is used to promote understanding. This is expected to learn critical thinking, problem-solving, and communication skills necessary for implementing countermeasures, as well as the acquisition of knowledge about information security. In the class, the author lectured on the students, approximately 80 minutes to learn about information security threats, related incidents and countermeasures. After that, for about 80 minutes, the students were divided into groups of several members and played the card game as the exercise to learn how to prepare in advance for security and how to respond to an incident in the first place. In this game, the students play the role of CSIRT in a company, that responds to information security incidents. The teams choose from cards of proactive measures for information security and initial responses to incidents with the goal of increasing the value of the company (a score corresponding to the stock price). The team with the highest score corresponding to the stock price wins. For proper selection, it is essential for the team members to discuss the choices while researching. In the questionnaire survey, some students answered that they could understand that proactive measures may or may not be effective for incidents that occur. The other student raised the question of whether it is necessary to understand not only "measures that should be taken" but also "measures that should not be taken." These findings suggest that the practice is effective in learning critical thinking and problem-solving skills. Furthermore, based on the experience of this practice, the author suggested how teachers can manage their classes in utilizing games according to the number of students. This suggestion implies management idea for not only face-to-face classes but online classes.

**Keywords:** Exercises, Information security, Card game, CSIRT, Security response.



## Cross-Validating Four Measures of Technology Integration: Stages of Adoption, CBAM LoU, ACOT, and TPACK Core

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**Abstract.** This paper contains a cross validation study of four instruments commonly used to assess educator proficiency in technology integration. Data for the validation study were contributed by 357 teacher preparation candidates enrolled in university coursework in the Netherlands. A previous study based on analysis of 1068 survey responses from teachers in 48 US states confirmed that three of the measures – Stages of Adoption of Technology, CBAM Level of Use, and ACOT stages of instructional evolution – formed a consistent self-report measure that had stable construct validity and aligned well with anticipated changes in educator attitudes as level of technology integration progresses. In the current study researchers sought to determine if a fourth, brief, 9-item measure named TPACK Core aligned with and complemented the three other well-established technology integration instruments. Researchers also sought to determine if the four instruments, when used in combination, together exhibited acceptable psychometric qualities in a European context. Results were that the Dutch data produced an internal consistency reliability estimate of Cronbach's Alpha = .834 for a higher-order measure consisting of four scale scores, one from each instrument. This would be judged as 'very good' according to established psychometric criteria. Higher-order factor analysis and multidimensional scaling reconfirmed the common alignment of these scales, which led to the authors' recommending the use of all four to produce a robust self-report measure of technology integration proficiency. Implications are that this 15-minute administration process would produce four scale scores each of which could be used to compare findings to previous studies using any of the four. In addition, using all four would result in a highly-reliable, aggregate measure of technology integration proficiency known to be robust across international contexts. This could provide a richer context of interpretation, to be used by school systems locally to target the level of the next phase of technology integration professional development for teachers, or by policy makers at the educational systems level to better understand the current status of practicing teachers. The use of four brief but individually validated scales can provide a robust measure of technology integration proficiency that can be expected to operate well in a wide range of educational contexts.

**Keywords:** Cross-validation, technology integration measures, proficiency

## A system to realize time- and location-independent teaching and learning among through sharing learning-articles

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**Abstract.** In recent years, attempts to have learners teach and learn each other have been attracting attention in the field of education. One of the reasons is that major changes are occurring in the conventional educational style. In the past, students were taught only one-way by teachers, and it was difficult for them to acquire a proactive attitude toward learning. On the other hand, in a rapidly changing global society and information society, it is essential for students to actively collect information and take action on their own. It is believe that attempts to realize mutual teaching and learning among learners will contribute to the development of human resources who can cope with such a modern society.

In this study, we propose a framework that enables learners to teach and learn from each other without depending on time and place. Teaching and learning are conducted through learning articles, which contain information about what learners have learned on their own and the process by which they have understood the content of the course. The proposed framework comprises two subsystems. One is a frontend system for the submission, review, and publication of learning articles. The other is a back-end system for storing and analyzing learning articles. By preserving learning articles in the database, the proposed system has the advantage of passing on knowledge and expertise to the next generation, much like a library. The proposed framework is expected to be effective not only in expanding and deepening one's own learning by reading others articles, but also in reflecting on one's own learning by writing. Also, the method has a mechanism to encourage the submission of learning articles on topics with few submissions or difficult topics in order to ensure sustainable operation.

The experimental results of the developed system showed that approximately half of the learners felt that they could understand important points and solve problems about the process of learning by writing and reading learning articles. In addition, there are a certain number of learners who accept the mechanism to encourage the submission of articles, suggesting that the proposed method is expected to be sustainable.

**Keywords:** learner-centered design, learning-article, educational support system

## Awareness Support with Mutual Stimulation among People to Enrich Group Discussion in AIR-VAS

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**Abstract.** While the Internet has made it possible for people all over the world to be connected, we have faced the wall of the diversity of values. Although we often have to consider or respect other people's values, it is not easy to sense them due to the limitations of our knowledge, experience, and imagination. We have worked on how to mutually consider unfamiliar values and obtain a synergetic effect among people by developing a discussion support system called AIR-VAS. AIR-VAS is a system aiming to support being aware of other people's values in group discussions. AIR-VAS functions to recognize characteristic opinions of a group and share them among all people engaging in the discussion. Through the sharing of opinions, people can obtain different viewpoints on the issue of the current discussion so that AIR-VAS can stimulate people to generate/evaluate/analyze ideas. AIR-VAS has the function of visualizing statements presented during a discussion as the word co-occurrence network. We realized opinion sharing as the process of the network re-construction, including presented sub-network as an opinion of other groups. The experimental result showed that the system successfully supports achieving the diversity of ideas.

**Keywords:** Discussion support, Idea generation support, Awareness, Word co-occurrence network, Summarization.

## An Approach to Personalized Quiz-Based Learning

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**Abstract.** In this paper, we propose a personalized quiz-based learning framework and describe an approach for building such a learning environment. A personalized quiz-based learning is based on a framework which has the feature to monitor a user's learning activities such as marking and annotating on a digital textbook. This kind of personal learning activity focuses on a part of the digital textbook e.g., some concepts, phrases, sentences and so on. A quiz question about a focused part will be generated by using the analysis of the personal learning activities, the teaching text data, and related knowledge. The generated question will be transferred to an e-learning system. The learner is tested later by using the question to decide whether the learner has understood the focused part of knowledge.

There are different ways to mark and annotate in books, e.g., underlining, circling, writing a comment, making symbolic marks, and so on. To simplify our research, we proposed to use single underlining and circling, i.e., just indicating the focused part in an expository text. Based on these markings, we designed three types of quizzes to be generated, i.e., quizzes to strengthen knowledge of a focused part (KF), to deepen the knowledge (KD), and to widen the knowledge (KW). A simple fill-in-the-blank question can be generated easily. However, which part should be blanked, how to identify the effective parts, when to present the quizzes, how to order the quizzes, for different learners the answers will be different. It is necessary to combine the marked parts and the context of the text to generate meaningful questions. It is also necessary to conduct user studies to evaluate learners' different preferences.

We approached this work by starting some fundamental procedures manually, e.g., manually extracting marking and the corresponding text part, manually executing a quiz generation function, and manually registering the generated questions in the question bank. We tried implementing the semi-automatic question generating system from markings in a digital textbook. The system was built on Moodle learning system using plug in button module. A learner can generate personalized quizzes and start self-test by clicking the quiz-based learning buttons according to his/her own timing. Our initial experiments were promising, but they were insufficient to verify educational or learning effects because each trial was executed in a short term repeatedly. We plan to implement the automatic system and conduct longer term user studies to evaluate the proposed framework of personalized quiz-based learning.

**Keywords:** E-Learning, Marking, Quiz Generation.



## Time-shifting method to mitigate the stagnation of discussions to promote collaboration on SNS

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**Abstract.** In this study, we propose a function of SNS to reduce stagnation of discussion which hinders knowledge-creation and knowledge-building activities on SNS. In knowledge-building community, members are expected to engage actively in collaboration with members for identifying problems, solving problems, and reflecting on the problem-solving process. In the process, the members are expected to perform with their collective cognitive responsibility (CCR) in the collaboration. However, the members may have difficulties acting with their CCR when the discussion stops. In online-only situations, the stagnation of discussion occurs more often than in face-to-face situations because group awareness is limited in online situations. To encourage members' collaboration on the online situation from the group-awareness viewpoint, we developed a function for promoting collaboration through changing the appearance timing of posts on SNS. The function classifies posts according to their time sensitivity and the degree of the post author's contribution to the community. For instance, posts with low time sensitivity and posted by frequently contributing members are stocked for a while and displayed when posts on SNS decrease. We examined the function using log data of a community: members in the community maintain an active learning classroom in the university and were expected to the improvement of equipment, devices, and support methods for teachers' use of the classroom. The results showed that the appearance timing of posts on an SNS dispersed more than in natural settings. We will implement the developed time-shifting function to active SNS in the future.

**Keywords:** Stagnation of discussion, Knowledge Creation, Group Awareness, SNS.



## Understanding the Stakeholder Perspectives on Assessing Educators' Digital Competence

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**Abstract.** Digital competence of educators is one of the key factors affecting wide-scale digital transformation of education which is one of the major aims in European Digital Education Action Plan (2020). To plan, conduct and report progress in digital competence development requires ability to measure this competence. Hence, the importance of valid, reliable and usable digital competence assessment has been increasing among researchers, policy makers and teacher educators in recent years. While there exist a number of different instruments for assessing digital competence, there are not many comparative studies that would inform different stakeholders how to choose a suitable instrument to match specifically their context and goals. Furthermore, there is a lack of understanding of needs and expectations of various stakeholders when they consider assessment of educators' digital competence. This paper summarizes a study that explored the stakeholder perspectives in digital competence assessment and related trade-offs.

**Keywords:** Digital Competence, Assessment, Educators, Instrument Validation, Trade-off.

## An Evaluation of the Flipped Classroom Approach Toward Programming Education

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**Abstract.** In the academic years (AY) 2020 and 2021, due to the COVID-19 pandemic, many lectures in universities had to be conducted online. Our faculty provided programming classes in-person instead of online in such a situation because the programming exercise plays an essential role in classes. Moreover, face-to-face interactions in programming exercises are considered significant for instructors can intensively supervise students' work. The author created lecture videos for lessons provided as hybrid online courses in the AY 2020. Therefore, it was easy to move from regular classes to flipped classes utilizing such resources. In addition, the migration from in-person classes to online classes has resulted in the utilization of a learning management system. It has also helped us introduce several learning analytics methods in practical educational fields. This paper provides an overview of the flipped classes for programming courses conducted by the author in the AY 2021 and students' attitudes toward participation.

**Keywords:** Programming Education, Flipped Classes, Learning Analytics.

## Cycles in State Transition as Trial-and-errors in Solving Programming Exercises

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**Abstract.** In recent years, Japan's education system has started regarding trial-and-error favorably and is accordingly evaluating its strategy. Evaluation of trial-and-error has become crucial to learning analytics. Jigsaw Code is a programming exercise that gives students shuffled code blocks of a solution program, including fake ones, and asks them to rearrange the blocks in the correct order. It logs the solving actions of each student. This paper shows that the cycles in the state transition of the solution indicate the students' trial-and-error process. Two hundred thirty undergraduates solved 11 puzzles (problems) of Jigsaw Code. We analyzed the transition of the solution sequence at each solving action and found cycles in the state transition. For 97% of the plays, including the frequently appearing cycles, the first state of each cycle was the subsequence of the final solution. A cycle in the solution state transition shows that the student returned to the cycle's first state after searching for other solutions, as they probably regarded the cycle's first state as leading to the correct final solution.

**Keywords:** Trial-and-error, Programming Exercises, Cycles in the State Transition.

## Design and Practice of an Elective Python Programming Course in General Education

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**Abstract.** At Kyoto University, a course teaching Python programming has been held as an elective course of its general education program since 2018 A.Y. Computer programming is taught widely in teaching informatics in general education in universities aiming to understand its concept with some experience. However, there are various needs in learning computer programming for actual use in the university, and elective programming courses in general education can accept such needs beyond schools and departments.

With such background, this paper discusses an elective programming course of Python in its course design, development of learning material, learning environment, class operation, and assessment as well as experience of its practices.

This course assumes novices in computer programming including students in liberal arts/humanity schools as well as those in scientific schools on one hand. On the other hand, this course set its goal to make them acquire authentic programming skills. Considering such requirements, course topics include GUI programming to understand the event-driven programming, and the development method of programs as well as basic elements of programming such as variables, substitution, sequential execution, conditional execution, and repetition. After learning the development method, students are asked to try their own programming projects.

Textbooks have been developed with a sufficient explanation of the topics considering their use for self-study. With this textbook, a kind of flipped classroom can be conducted where students prepare sample source codes and execute them before classes, and tackle modification of them during the class hours with the assistance of instructors.

Courses have been held since 2018, and in 2020 it is held online. The practice of the course in 2020 which accept 216 students is reported also in this paper. The change in submissions of assignments asked in classes shows the difficult topics for students. The difference in pass rates was small between students in liberal arts/humanity schools and those in scientific schools. It shows this course was well designed for the assumed learners.

**Keywords:** teaching computer programming, Python, general education, flipped classroom, online education

## A Preliminary Report on Novice Programming with Natural Language Translation

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**Abstract.** Recently, text-to-code translation has become more practical due to the rapid advancements in deep learning technology. It could be useful to apply to programming education. We have newly developed Kogi, a transformer-based text-to-code translator that generates Python code from intention written in Japanese. In this study, we focus on how text-to-code translation help students to program.

To investigate pedagogical effects, we have provided Kogi with students in a real-time manner. Using Kogi, students could write what they want to program in a natural language and then obtain the translated code by Kogi. This approach could help students reduce their difficulty in programming from scratch and keep their focus on programming tasks.

We delivered Kogi to students in an introduction-level data science class with Python. The students solve several exercises with Kogi, and we surveyed their experimental feedback about Kogi. We confirmed that most of the students received significant help in programming from Kogi and desire Kogi's help in the long run.

**Keywords:** Machine Translation, Programming Education, Novice Programmers, Usability.



## Teaching Computer Science Unplugged in Online for Undergraduate College Students

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**Abstract.** Computer Science Unplugged was originally designed for teaching in face-to-face environment and aimed for teaching children. But the author has been using it in teaching at a class of an university. And after COVID-19 pandemic began, the author modified it to fit to the online environment and taught it via GoogleMeet or Zoom. The author acted as the teacher and has taught “Count the Dots—Binary Numbers,” “Battleship—Searching Algorithms,” “Lightest and Heaviest—Sorting Algorithms,” and some other activities. In addition to those activities of CS Unplugged, the author used Tower of Hanoi for introducing the concept of recursion, and Algologic puzzle for introducing programming. In “Count the Dots,” the author used a set of cards which represent binary digits, and had also each student held a set. In Battleships, breakout rooms or equivalent facility of GoogleMeet or Zoom were used, in which each breakout room was assigned for each pair of students. In Sorting, the author and students each has a set of playing cards for simulating sorting algorithms. In Towers of Hanoi, the author explained the recursive procedure by tracing it on multiple copies of the procedure. For each activity the author collected students’ evaluation by questionnaire. Almost students answered that many activities above are evaluated as “5(very good),” “4(good),” or “3(so-so).”

**Keywords:** Computer Science Unplugged, Online Class, Undergraduate Students.

## Curriculum development and practice of application creation incorporating AI functions; Learning during after-school hours

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**Abstract.** There is an urgent need to develop human resources who can utilize the power of AI and data in order to enrich society through technological innovation and value creation. On the other hand, in school education, due to the framework of each subject and time limitation, it is difficult to implement a curriculum to work on application creation. Therefore, in this study, we attempted to develop and practice teaching materials for developing iOS applications for junior high and high school students in order to provide opportunities for interested students to learn independently during after-school hours. As a result, the students' responses on programming showed no significant change for the experienced students, but "surprise" and "feeling that I can do it" were meaningful learning opportunities for the beginners. Looking at the responses of the students regarding AI, although they knew the term AI, their perceptions varied from "humanistic", "familiar", and "coexistence with AI".

**Keywords:** Curriculum Development, Application Creation, AI function, learning during after-school hours.

## The Current State of Computer Education across the Australian Schools System

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**Abstract.** The ever-changing nature of technology in a globally inter-connected world has placed our educational institutions at the forefront of ensuring a future-ready workforce. More than ever before, the regular revisions, refreshes and re-designs of school curricula, especially in the domain of computer science education, need to ensure that the knowledge and skills that students acquire will adequately prepare them for progressing into either university, a vocational pathway, or directly into the workforce. School computer science courses are therefore uniquely positioned with multiple opportunities to immerse students in authentic real-world problem-solving challenges, that will encourage the development of a collection of key skills. When faced with a complex problem to solve, students need to be able to demonstrate the resilience/ability to work collaboratively, creatively and to think critically. One other fundamental set of skills that is gaining much-needed traction around the world, are the computational thinking skills of decomposition, pattern recognition, abstraction, and algorithm design. This paper will provide a brief overview of the teaching of the Digital Technologies curriculum from the Foundation Year to Year 10, before sharing a deeper insight into the current aims, rationale, knowledge and skills as they manifest across each Australian State and Territory.

**Keywords:** Digital Technologies Curriculum, Computer Science, Senior Secondary.

## Pedagogical adaptation to ICT in Australia

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**Abstract.** Digital computers have developed over the past 70 years or so. Therefore, it is possible to review social adoption and subsequent educational transformation. This paper briefly looks at the generation of new technologies in general, and their subsequent adoption into social understandings. It then looks at the adoption of new technologies into education and asks how quickly they are translated from society to schools. A national survey of Australian schools was undertaken to see how well and how quickly curriculum planners adopted computers, and subsequently how fast these ideas were implemented in classrooms. 307 schools responded to the survey, showing the 'patchy' nature of this innovation dissemination. The time from curriculum awareness to full implementation of the Digital Technologies subject in schools was estimated to be 7-12 years. Since computing technology is advancing rapidly, quantum computing in schools was examined and future curriculum revisions mooted. The paper concludes by asking how best school curricula should adapt to technological developments.

**Keywords:** Informatics, Computing curricula, Implementation time, Case study, Quantum computing.

## PICAPICA Z: An Interactive Smart STEAM Educational Approach via a Combination of Programming, Networking and Arts

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**Abstract.** The new Japanese national curriculum emphasizes the need to develop information and communication technology (ICT) skill. Educational content related to programming has been enhanced in grades 6–12 in pursuit of this goal. For example, junior high school students can learn to program interactive content. During high school, in addition to programming, students study information communication networks, including information and network security. This educational trend is not limited to Japan. Educational programs in Asia, Europe, the United States, and other countries around the world are transforming and expanding their educational content in fields related to ICT. An emphasis on science, technology, engineering, arts, and mathematics (STEAM) education is part of this trend. In learning activities related to STEAM education, programming can easily be linked to other learning items. A computer program is a type of language. Expressing STEAM-related ideas in a computer-readable language is a form of programming. Programming can play the "glue" role in the STEAM activities. We think that the design and coding of programs can resolve educational issues related to STEAM. If students have a programming abilities and senses, they can interpret their ideas into computer-readable expression. Then computer simulates or perform the codes. The students can judge their ideas are suitable for the problem solving or not. This study proposes educational materials regarding the configuration of information and communication networks. These materials are developed to support learning in junior high school technology and high school information studies using only one source. In junior high school technology courses, the interactive contents are developed using information and communication networks. In high school information studies courses, basic issues related to the structure and components of information and communication networks are covered. In the proposed educational material, the micro:bit is used as the main control device. By extending the Microsoft MakeCode, which is the programming environment for the micro:bit, we propose a smart learning environment that supports the understanding of interactive programming and information communication network architecture.

**Keywords:** Educational Material, Information and Communication Networks, Programming, STEAM Education.



## ELSI (Ethical, Legal, and Social Issues) Education on Digital Technologies: In the Field of Elementary and Secondary Education

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**Abstract.** This research proposes the need to introduce ELSI education (education of ethical, legal, and social issues) on digital technologies in school education, such as primary and secondary education. Nowadays, various advanced technologies such as artificial intelligence and data science are used in our daily lives. New ethical, legal, and social issues arise in the use of new technologies, and the concept of ELSI, which examines these issues, is gaining popularity. ELSI is the examination of the ethical, legal, and social issues and implications of science, technology, and research. In order to properly utilize advanced technologies, it is necessary to involve the general public in ELSI, and education on ELSI is necessary to obtain the basic knowledge and understanding for this purpose. This paper defines ELSI education as “Learning with ELSI” education and proposes the necessity of introducing ELSI education in primary and secondary education. In order to implement ELSI education, teachers need to have sufficient knowledge of ethics, law, and society, and they also need to be up-to-date with the changes in the information society. ELSI education should not be introduced as an entirely new education, but as a new concept on top of existing education. As a concrete practical example, a learning using machine-learning chatbot statements is considered. In this example, it is shown that by viewing the relationship between chatbots and society from the perspective of ethics and law, it is possible to realize learning that considers how to be mindful when utilizing technologies. In an age in which advanced technologies are emerging one after another, it is important to promote ELSI education according to the developmental stage of learners from the early stage of primary and secondary education. ELSI should be regarded as a “handle” for realizing better education, and its practice should be promoted.

**Keywords:** ELSI Education, Ethics, Elementary and Secondary Education, Artificial Intelligence, Advanced Technologies

## Learning outcomes of a coding-based board game for beginner-level students learning to program

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**Abstract.** Several board games for learning programming have been proposed. Although these board games are an easy approach to learning programming, the correspondence with actual coding is weak and there is a gap between the two. Thus, the gap is a limitation to learning programming. We developed a board game for novice programmers to address this issue. This game utilizes a coding-like game system to incorporate the basic programming concepts of variables, operations, branching, and repetition. In this study, we instructed six novice programming students aged 11–14 to play this board game to observe its learning effects. The students were then assessed experimentally by having them answer a quiz related to programming. Thus, simple content, including basic arithmetic operations, code structure, and variable concepts was well learned. However, the concept of branching and repetition was not effectively retained. In the future, we will enhance the developed board game to address this issue.

**Keywords:** Educational Board Game, Programming Education, Software Engineering

## Using R Language to Analyze Programming Learning Process of Ai. R Cord utilizing AR

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**Abstract.** The purpose of programming education in elementary school is to give students the ability to correctly understand and utilize computers. The ability is extremely important so that the students to be more active in the coming society 5.0. Programming education involves the use of computers and learning materials, but support for teachers needs significant improvement. In this paper, we collect students' learning data using a programming material named Ai. R Cord utilizes augmented reality (AR). We also analyze the learning data from various perspectives using the R language. This will be used to evaluate the understanding level of the students, find out the causes of incorrect answers, encourage students with low levels of understanding by reviewing their work, and identify common mistakes in each question, which will be used to improve the teaching activity and to provide guidance to the students. Through visualization of the learning data, students' achievement and usage status can be easily analyzed. Furthermore, by using advanced data analysis methods such as principal component analysis and cluster analysis, we also obtain valuable knowledge that can be used for future instruction, such as trends in performance by subject and classification of students based on their level of understanding.

**Keywords:** Learning Analytics, Programming Education, Data Visualization, Principal Component Analysis, Cluster Analysis.

## Reflection Support with Summarized Screen Recordings of the Visual Programming Tool

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**Abstract.** With the introduction of the programming education to primary schools in Japan, many students are now participating in programming workshops utilizing visual programming environments such as Scratch. Most of them enjoyed programming and some tried to further work on their self-motivated projects. On the other hand, their programming experience is often limited in the period of a workshop, and there are not so many cases where they keep working on their projects spontaneously after attending such a workshop. To overcome this situation, reflecting activity would be an important factor for children to be encouraged to further come up with new ideas leading to continuous creative activities. In this paper, we propose to use summarized screen recordings to support the reflection activity along with a method to generate a movie of a few minutes long extracted from a screen capture which can be taken on PCs used by children. Summarized screen recordings are generated by using the computer vision technology provided by OpenCV. The method is organized into two steps. The first step extracts candidate scenes that are possibly included in a summarized screen recording. Then the second step eliminates similar scenes from the extracted candidate scenes. The extraction of candidate scenes focuses on the movement of sprites and script blocks on the Scratch window, which can be identified by detecting feature points on the screen and matching the feature points between adjacent scenes. Then similar ones in the candidate scenes are eliminated by comparing feature points in adjacent scenes, finally forming a summarized screen recording. We examined the contents of the summarized screen recordings extracted from screen captures taken in actual programming workshops to evaluate how well the summarized screen recordings are organized. Evaluation has been made in two criteria: an objective measure using precision and recall representing how well the important scenes are included, and a subjective measure using a questionnaire asking workshop participants about the usefulness of the summarized screen recordings for their reflection. The result of the precision and recall indicates that about 65% of the expected scenes could be extracted while about only 30% of the extracted scenes could match the expected scenes. For the questionnaire, many participants responded with positive answers for reflecting on their activities. For future works, we need to improve the method to reduce the redundancy of the generated movie.

**Keywords:** Visual Programming, Screen Recordings, Reflection Activity.

## Validity of animation when finding errors by Chuggington

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**Abstract.** Programming has been a compulsory subject in Japanese elementary schools since 2020. Although elementary school students are expected to obtain logical thinking and creativity, effective learning methods have yet to be clarified. One approach is to use animation. Herein a new animation method using Chuggington, which is a visual programming tool designed to help imagine execution results, is proposed. The effect of animation to find errors is validated experimentally. In this experiment, six university students found errors with and without animation in programs with similar levels of complexities. Additionally, a new calculation method using visual programming is proposed to measure the complexity of Chuggington courses. A post-experiment questionnaire about the animation effect and perceived difficulty indicated that the perceived difficulties and the calculated Halstead complexity are approximately matched. The animation in Chuggington reduced the solution time, and the participants' answers were uniform regardless of programming experience when animation was present. However, the small sample size is a huge threat to validity due to the pre-experiment, and the results may not translate to a large sample size or a different group. In the future, a similar experiment should be conducted with elementary school children.

**Keywords:** Animation, Visual programming, Chuggington



## Characterization of knowledge transactions in design-based research's workshops

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**Abstract.** PLAY is a design-based research project which gathers different communities of experts in collaborative workshops. Those latter are designed to create an educational game (Geome) to guide classroom visits to the Museum of Nature at Sion in Switzerland. Theoretical models in the sciences of education are tested through design, experimentation and evaluation of the game. In this paper, we investigate knowledge sharing by researchers, teachers, computer scientists and museum staff members during collaborative workshops. More specifically, processes of knowledge sharing in verbal interactions are under our scope. We analyze the game Geome as a boundary object. We characterize uni- or multilateral transactions according to how reciprocally the meaning of knowledge is negotiated. We also note the explicitness dimension of knowledge transactions. In conclusion, these results are addressed in the light (i) of the development of skills among the actors involved in the workshops and (ii) the creation of theoretical models in educational sciences.

**Keywords:** Knowledge translation, design-based research, boundary object, knowledge co-production, collaboration

## Digitalisation of Education in the Global South: Conditions and Concerns

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**Abstract.** This paper seeks to contribute to a broader discussion on the critical research agenda in development and technology studies in education. Particularly the situation after pandemic school closures has revealed immense global inequalities and disparities in online education. With new efforts to alleviate the situation, attention has to be paid to the constraints and risks that are incurred in the digital transformation of education. This paper explores and analyzes the risk areas dividing them into technological infrastructure and software and platform concerns, and to wider social, ethical, political, epistemological and cultural issues. A systematic analysis would help in risk evaluation for better planning and decision making in the global south. The paper argues that technological transitions need support in the form of considerable expertise, as well as involvement of the local communities to ensure sustainable solutions in education.

**Keywords:** digital education, development, infrastructures, technology risks

## An alternative perspective on computer self-efficacy based on group and gender composition

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**Abstract.** Gender remains as a controversial issue when analyzing students' attitudes and results of their interaction with computers. This paper draws conclusions about computer self-efficacy based on the interaction among students with no technological background when asked to create a prototype of a website. The study was carried out for eight consecutive years, and 536 undergraduate students participated. The experience showed that the students tended to group themselves in work teams of the same gender. The nature of students' association, different from the expected with mixed gender, led to consider that unconsciously the students were showing their level of perceived self-efficacy in the use of computer applications. The reason why this assumption could be considered as consistent lied on the fact that students were being evaluated, and under this circumstance the coherent behavior is that which guarantees the best grades. The evaluations revealed that there were no significant differences when comparing the performances of groups made up of females, males, or mixed genders. This experience may be of interest as it questions some assumptions about group and gender interactions with computers.

**Keywords:** Computers, Gender, Groups, Self-efficacy, Undergraduate.

## Digital Literacy in Formal Education over the Past Decade: A Systematic Review

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**Abstract.** The COVID-19 pandemic abruptly thrust online teaching and learning into the limelight of the global stage, consequently pushing digital literacy as it relates to formal learning, teachers, students, and parents, towards the foreground of education. In light of this, there is a need to understand the implications of digital literacy in the context of teaching and learning during the pandemic years and the research and literature surrounding it. This literature review strives to gain a global overview of the empirical studies on digital literacy in formal educational contexts by systematically reviewing 574 peer-reviewed articles published between January 2010 and December 2021. It aims to provide the theoretical background and literature for a development project on digital literacy in the post-Covid era by systematically mapping the literature pertaining to digital literacy globally and shedding light on trends, particularly during the post-Covid years. A descriptive statistical analysis will be used to investigate the full-text articles in terms of demographics of the studies (including publication year, geography, educational domains, and research settings), research topics, research participants, and research methodology adopted (including research methods and data sources). It is anticipated that the descriptive statistical results will demonstrate differences in distribution within the studies in terms of demographics, research topics, research participants, and research methodology. The number of articles published before and during the COVID-19 pandemic (during 2010–2019 and 2020–2021 respectively) were also compared as part of our findings. The analysis demonstrates a significant increase in the number of studies published during the pandemic compared to preceding years. There is also a likelihood that most studies published during 2020–2021 may have been conducted with education during the COVID-19 pandemic in mind, either as a focus, an influencing background element, or factor for consideration. The findings and conclusions from the analysis will be presented at the conference. The results of the review will shed light on the global trends in digital literacy research before and during the pandemic. They should reveal areas of interest, challenges, and affordances when it comes to digital literacy and digitally inclined teaching and learning practices. Moreover, the results should help identify research gaps in the field of digital literacy in formal educational contexts and provide implications for future studies.

**Keywords:** Digital Literacy, Formal Education, Remote/Distance Education, Hybrid/Blended Education.

## High School Students' Approaches to Cheating in Remote Education During COVID-19 Pandemic in the Czech Republic

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**Abstract.** Prior research has documented that there is a noticeable increase in online cheating during remote education that is caused by the Covid-19 pandemic. This study attempted to investigate Czech high school students' approaches to online cheating during remote online learning. Using a mixed-methods research paradigm, the researchers utilised an online questionnaire to obtain the views from the students (N=316). The researchers also used individual online interviews with teachers (N=7) to complement the students' responses to the questionnaire. The study's findings indicated that remote online education led most students to believe online cheating is excusable since they were unwilling to learn and found the subjects not engaging and helpful for them during such a period. Besides, digital equipment (e.g., mobile phones, sharing a screen with another person) during online tests were the most preferred technical instruments for cheating. Using resources on the Internet was the most frequently self-reported online cheating. Students' recommended solutions to prevent online cheating were presented into three main groups of recommendations, which were (1) pessimistic, (2) practical, and (3) critical and realistic. The findings further suggest that teachers consider students' needs and expectations from assessment in online education and create possibilities for formative assessment to minimise the inclinations towards online cheating.

**Keywords:** Online Cheating, Remote Online Education, High School, COVID-19 Pandemic.



## The Role of technology in Communities of Learning Collaboration and Support

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**Abstract.** Continuous professional learning is gaining currency in Kenya, due to several factors including the Teachers' Service Commissions' Policy (Appraisal and development). This has facilitated the inclusion of practicum sessions. This explorative interpretive study undertook artifact analysis to establish the role of social media in the practicum. The study reviewed 560 schools from 3 counties after three days of face-face sessions during a school term. Six platforms' interactions, Edmodo, WhatsApp, Slack, Kaizala, Twitter, and Facebook were reviewed. Activity logs (posts and comments) were analyzed over the 12 months' practicum (communities of learning) sessions. The analysis focused on enrollment, traffic, content, type of activities, quality of engagement, and opportunities for support and learning. The finding revealed that currency, relevance, importance, camaraderie, and learning as factors that guided the engagement. The use of social media extended the learning experiences, continued cohort engagement, increased numbers of reached, and facilitated the transfer of principles into practice.

**Keywords:** Practicum, Professional Learning, Technology infusion.

## A Taxonomy Of Video Genres For Use In Education

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**Abstract.** Videos play a fundamental role in online learning and online courses. Videos are also a valued resource which can be designed and used by learners in many different ways. Surprisingly, research on video for educational use is rather limited, a matter which goes for video-based learning and online courses. That said, the current research horizon on video research offers very few perspectives on how to design videos and how they can effectively be applied by educators to foster learning. Predominantly, researchers use quantitative methods to measure the performance of videos, meaning that a strong learning analytic research tradition has emerged. Missing from the research horizon, however, are studies that develop frameworks or guidelines for pedagogical use of videos. For example, we find very few studies that outline how instructional videos can be designed into an online course. In this regard, this paper outlines and suggests a taxonomy of 10 video genres which educators can use in the design of video-based learning environments or in online courses. By using a quantitative research design, the taxonomy of 10 video genres was devised. The taxonomy of video genres was developed from a data set which based on use of videos genres in three teacher trainer online courses at a university college in Norway.

**Keywords:** Videos, MOOCs, online courses, taxonomy.

## Tracking Epistemic Interactions from Online Game-Based Learning

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**Abstract.** This paper draws on an empirical work dedicated to assessing the relevance of an online training course for pre-service teachers. The course is dedicated to the legal rules governing the use of digital educational resources. It consists of a game-based learning session with *Tamagocours*, an online Multi-player Tamagotchi. Based on the digital traces collected from 242 players, we conducted a factor analysis to classify the players according to the interactions that took place during the game session. Our analysis shows that the game is played in very different ways depending on the teams. It also provides evidence that the interactions that take place are not always epistemic interactions and that some players use avoidance strategies that work against learning. Our contribution therefore focuses on a method for understanding how a game is played and the potential effects of playing on learning.

**Keywords:** Game-Based Learning, Epistemic Interactions, Collaborative Learning, Playing Analytics.

## A Conceptual Framework for Automatic Generation of Examinations using Machine Learning Algorithms in Learning Management Systems

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**Abstract.** The ongoing transition of education from face-to-face to online learning has seen increased application of machine learning to optimise learning and assessment processes. Learning Management Systems (LMS) such as Moodle, Blackboard and Canvas are used to conduct electronic learning (e-learning) and electronic assessment (e-assessment). These LMS systems automatically generate exams for student assessment. However, the perceived low quality of these exams has led them to be used for formative assessments and not for summative assessments. One way to ensure high quality exams are generated by LMS systems is to ensure the questions cover various difficulty levels in reference to a specific educational taxonomy. Two commonly used taxonomies include Bloom's Taxonomy and the more recent Revised Bloom's Taxonomy (RBT). Currently the RBT has been recommended for classification of exam questions into different categories of knowledge. In this research, we first review studies on exam question classification using educational taxonomies and then we review automatic generation of exams from question banks. From this review, we define parameters necessary for a quality exam based on RBT. Finally we propose a conceptual framework which will apply machine learning algorithms on the identified parameters to automatically generate a quality exam from a question bank. We intend to do further research by developing a prototype based on the conceptual framework. To test the quality of exams generated by the prototype, the prototype will be validated in Moodle LMS within a Higher Education Institution (HEI) using a true experiment in a specific subject domain.

**Keywords:** Automatic Generation of Exams, Machine Learning, Bloom's Taxonomy.

## Layers of Knowledge Leading to E-Portfolios

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**Abstract.** E-portfolios are considered an innovative and effective instrument to assess students' learning, allowing for a more comprehensive consideration of individual learning processes and acquired competences. As a composition, an E-Portfolio lets learners express themselves using digital artefacts (texts, graphics, and videos using a vocabulary both accessible to them and to their readers). The realization is more personal with the knowledge expressed in a re-appropriated manner and with individually deepened subjects. Teachers of these courses assess the acquired competencies and knowledge of the students by evaluating submitted E-Portfolios based on criteria such as topical completeness, subject-specific depth, use of relevant resources, the originality of presented artifacts, quality of the explanations, formal aspects, and expressed reflection on the subjects (e.g. connections to their own social environment). However, to assess, a wider context has to be considered.

In addition to individual E-Portfolios, the following representations of knowledge are involved in the learning process: knowledge maps and lesson plans created by teachers, learning materials or coursebooks conceived by teachers, additional open learning materials, exercises, project results, and other artifacts designed and produced by students in the context of their learning processes, and teachers' rubrics guiding the assessment. Using the latter, the completeness and correctness of the acquired knowledge can be and must be assessed. E-portfolios promise a more comprehensive assessment of student's competences and their development in the context of learning process, but their assessment is clearly more complex and elaborate. We propose supportive technologies for E-portfolio assessment. They not only require integrating different layers of knowledge, but also providing effective access to these layers. We propose to use adequate visualizations and dashboards to depict structures such as the map of broad topics or ontological trees of conceptual objects.

The project AISOP (AI-supported Observation of e-Portfolios) targets to design and provide corresponding AI-based technologies and tools to support the assessment of E-portfolios. Natural Language Processing (NLP) provides the input to display connected representations of knowledge and visualizations that connect layers of knowledge, thus, supporting a teacher in its assessment of E-portfolios and a learner in the middle of writing. The project uses widespread platforms (e.g. Mahara) and NLP-tools (e.g. entity recognition in spaCy) and will deliver open-source tools and open corpora for the field of digital competencies.

**Keywords:** Learning analytics, E-Portfolios, AI, Evaluation, Assessment



## General Model for Design of an Integrated Learning Record Store System as Infrastructure in Learning Analytics on a University

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**Abstract.** In the recent decade, learning analytics (LA) has received increasing attention and educational support based on big data from students and their contexts accumulated in learning environments has been promoted in Japanese universities as well. To implement such educational support available throughout an educational institution, design of an institutional administrative system to manage data legally and ethically is needed besides an information system to uniformly collect and purposely provide data. And the administrative system requires policy in using student data, which meets requirements of a law on the protection of personal information in each country or region. This study proposes a general model of infrastructure in LA, which serves as an integration system to consolidate data logged in every learning environment adopted in an educational institution and controls its proper sharing with external systems for LA, as a solution to technical and administrative issues. We discuss creation of data use policy for this system in Japan, introduce requirements to build it, illustrate the model and its in-stance that could be implemented in Teikyo University.

**Keywords:** Learning Analytics, Learning Record Store, Data Use Policy.

## Improving a Model-Based Software Engineering Capstone Course

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**Abstract.** Capstone projects are a common feature of software engineering bachelor's degrees. We report on the experience and lessons learned from a decade of capstone projects at a small regional Israeli college. We first created a capstone process adapted to the department's model-based software design philosophy, cultural aspects of the student body, and the sparse industrial environment surrounding the college. After several years, we improved the process through the introduction of mandatory fill-in report templates. Analyses of ten years of project statistics and outcomes led us to an understanding of what capstone features led to better outcomes and how the report templates affected grading outcomes. Our templates are released under the Creative Commons Attribution-ShareAlike 4.0 International License and can be accessed at <https://bit.ly/se-capstone-templates>.

**Keywords:** Software design engineering, Student assessment, Software engineering education, Capstone projects.

## Visualizing Class Diagram and Sequence Diagram of Java Program in VR Space

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**Abstract.** Modern large-scale software is developed through a systematic process such as requirements definition, architecture definition, design definition, system analysis, implementation, and verification/validation. Various software development documents are created during the software process. Software engineering primers tend to confuse many software documents since they do not understand the relationship among the documents. We are developing VRale-SCM, a tool to visualize various software documents using VR space. Students can navigate the documents via relationship so that they can clearly understand the relationship. We develop a tool to generate and display class diagrams and sequence diagrams of Java programs in this paper. The tool is integrated into VRale-SCM. Class diagrams represent the program structure, while sequence diagrams represent the dynamic behavior of the program so these two diagrams are quite important to understanding Java programs. We utilize JavaParser to build an abstract syntax tree of the Java programs. Dynamic behavior of the Java programs is extracted by adding sensing code to the original program and by executing the converted Java program.

**Keywords:** Software Engineering Education, Class Diagram, Sequence Diagram, Virtual Reality, Software Process.

## Scaffolding Task Planning Using Abstract Parsons Problems

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**Abstract.** Interest is growing in the role of metacognition in computing education. Most work to-date has examined metacognitive approaches of novices learning to code. It has been shown that novices navigate through discernible stages of a problem-solving process when working through programming problems, and that scaffolding can be beneficial. In this paper, we describe a novel scaffolding task aimed at guiding novices through a crucial stage of developing and evaluating a problem-solving plan. We presented novices with a problem statement before working through an Abstract Parsons Problem, where the blocks present structural elements rather than complete code, to aid high-level planning before writing code. Comparing groups who experienced this approach with those that did not, revealed that novices who worked on an Abstract Parsons Problem before coding were more successful in solving the task and demonstrated improved metacognitive knowledge related to task planning when asked to identify useful future problem-solving strategies. Our observations from two courses over two years suggest that scaffolding students through a planning step prior to coding can be beneficial for students. We provide directions for future work in exploring strategies for providing this type of guidance, including the use of different types of planning activities, and studying these effects at scale.

**Keywords:** Automated Assessment Tools, CS1, Introductory Programming, Novice Programmers, Metacognition, Metacognitive Awareness, Parsons Problems.

## IDE Interactions of Novices Transitioning Between Programming Environments

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**Abstract.** Novices in introductory programming courses typically learn the fundamentals of programming using one of a wide of programming environments. These vary greatly in terms of the mechanisms they employ to assist programmers, including their approaches to compilation and error message presentation. It is yet to be established which, if any, of these mechanisms are more beneficial for learning. In this study, we utilize Java programming process data to investigate the interaction between novices and two different versions of the BlueJ pedagogical IDE, which differ substantially in terms of compilation mechanism and error message presentation. Specifically, we compare novices that used both BlueJ 3 and BlueJ 4 with those who exclusively used either and the effects of the order in which they transition between BlueJ versions. We find substantial differences between different cohorts in terms of error messages and compilation which provides evidence that programming environments play an important part in influencing the programming practices of novices. This work supports the hypothesis that the choice of programming environment significantly affects user behavior with respect to specific programming interactions and therefore it is reasonable to expect a difference in how these environments affect learning.

**Keywords:** Blackbox, BlueJ, Compiler Error Messages, CS1, Editors, Educational Data Mining, IDE, Java, Novice Programmers, Programming, Programming Environments, Programming Process Data, Tools



## A Comparative Study of Different LMSs used at Dokkyo University

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**Abstract.** Due to the COVID-19 pandemic, all teaching has shifted from a face-to-face environment to fully remote learning at Dokkyo University in 2020. To support the remote learning processes, there are three different LMSs (PorTa II, MyDoc(BlackBoard), and Moodle) used before 2020, and Manaba is a new contracted LMS after 2020. This study focuses on the differences in interface, usability, assessment, and feedback among the LMSs to contribute new strategies, advice, and solutions for effective remote teaching design with LMS which can be deployed in post-pandemic situations.

For example, Manaba has some problems with the interface. The learning content pages are in a different menu with quiz, survey, report, and forum features. Students will be confused about whether there is a quiz, survey, or report on the learning content page unless they have read or watched all the teaching materials to the end which the teacher may explain. As a solution method, teachers could link the different task page' URLs with the learning contents in one single page by which students could know what to learn and what to do at a glance.

For usability, there are different authentications in the four LMSs, a cross-system authentication system is needed for flexible online learning. There are file size and file type limitations in all the LMSs, therefore, other online storage should be utilized.

For the assessment, the learning log allows the teacher to gather feedback from students and to monitor data such as the amount of time spent online and which pages were accessed. In PorTa II, there is no feature to monitor students' learning activities. In MyDoc, teachers could only get a summary report of all the students' learning activities for each learning task. Manaba can only support displaying log data page by page, but not downloading it, which has no meaning for analyzing students' learning activities in detail.

Although there are many feedback features in LMSs like a forum, comments, etc. Teachers need to design and embedded the feedback features in the learning process and also need to supply timely, ongoing, and consistent feedback to support effective online learning.

Whatever the LMS is selected by the teacher, successful online teaching requires teachers and students to have access to appropriate resources, including technology, and well-designed learning environments. Teachers should not only master the online tools/technologies but also understand their pedagogical possibilities to achieve their teaching goals.

**Keywords:** Remote Learning, LMS, Teaching Design

## Digital Innovation in Assessment during Lockdown: Perspectives of Higher Education Teachers in Portugal

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**Abstract.** During the COVID-19 pandemic, lockdown policies forced higher education teachers to adopt remote teaching. This disruptive situation challenged teachers to continue delivering classes and carrying out assessment online. In order to investigate higher education teachers' perceptions about the online assessment, a survey was conducted in Portugal. The study focuses on digital tools and methodologies used in online assessment, first-time digital tools used, and the tools and methodologies that teachers intend to maintain in face-to-face assessment, as well as confidence in students' results. Data was collected online from May to July 2021. Participants (n=868) were from all fields of science and technology. Most of them (80%) reported the use of new assessment tools and methodologies during this period, but only 49% consider integrating them into their face-to-face teaching practices. Most of them (72%) have confidence in the results obtained by the students. However, some of them (36%) reported academic fraud situations. Digital tools related to summative assessment are the most prevalent, but methodologies related to formative assessment were also used. Only some teachers intend to use methodologies and tools in face-to-face classes used for the first-time during the lockdown. Curiously, most of the methodologies or the tools teachers intend to continue using are of formative assessment.

**Keywords:** Digital Assessment, Innovation, Higher Education.

## Analysis of the Process by Which University Faculty Members Come to Accept the In Assistant Faculty Development Support System and Use it to Reflect on and Improve Their Classes

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**Abstract:** Japanese universities are mandated to undergo faculty development (FD) programs. Accordingly, diverse FD programs have been implemented in Japanese universities. However, majority of these programs have been noted as “events” and have not led to daily classroom improvement activities.

Therefore, we have developed and are operating the “I<sup>n</sup> Assistant” as a system with mechanisms for promoting daily classroom improvement activities. I<sup>n</sup> Assistant is a system that organically links syllabi, class records, and a learning management system. I<sup>n</sup> Assistant allows faculty to record daily classes, through which they can reflect on their classes to find ways for improvement. For example, the class record screen initially displays the class plans described in the syllabus, allowing instructors to record their classes while comparing their own plans with the actual content of the classes. Further, these records are shared among fellow faculty members and stacked annually. At the author’s university, nearly 60% of the full-time faculty members use this system to record their classes, and it has become a system that supports their daily teaching activities.

Based on these operational results, we surveyed full-time faculty members who use class records to determine if and how these are being used to make concrete improvements to classes. An interview survey was conducted with 12 system users, along with an analysis using the M-GTA method. This revealed the process by which they accepted the system, reflected on their classes, and used it to make improvements. Additionally, it was found that even though external factors are key in commencing usage, as data is stacked, faculty members increasingly and voluntarily undertook efforts to improve classes using the system, and it soon became a routine. Regarding system implementation, the survey revealed that the following are promotional factors for active system usage: enabling the system to be linked with reinforcement measures that include external party evaluations, improving user friendliness using information and communication technologies, and enabling information sharing with colleagues and students. Thus, the implication is that initializing programs to establish the use of this system in universities, through external factors, could lead to routine creation and subsequently, improved classes.

**Keywords:** Faculty Development, System Development, Reflection



## A Study of Measurement of Mentoring Activities Using Text Mining Technology

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**Abstract.** P-TECH (Pathways in Technology Early College High Schools) is a pioneering education reform initiative to prepare young people with the academic, technical, and professional skills required for 21st-century jobs and ongoing education. Mentoring is one of the key activities of P-TECH for students to think about their pathways and build engineering attitudes. After each mentoring session, we take surveys to evaluate how the sessions affected the students and we achieved our objectives. Previously, we systematically analyzed only the quantitative questions. Since the surveys include open-ended questions, we added systematic analysis of the responses to the open-ended questions using text mining technology.”

The subjects of this paper were 30 high school sophomores in 2019. We mentored them eight times in 2019 and 2020 (their sophomore and senior years) and took surveys after each session. We gathered 1784 documents in total as the responses to open-ended questions and analyzed them with IBM Watson Discovery as a text mining tool.

The tool showed the top three frequent nouns were synonyms for “myself”, and the top three correlated nouns of “myself” were “future”, “thought”, and “way”. This indicates many students considered their pathways during the mentoring sessions and discussed them in their surveys. The tool also showed that the top correlated noun/verb phrases were “build ... plan”, “obtain ... advice”, and “have ... interest”. This indicates that students correctly received the messages intended by the mentoring. The tool also showed various trends of words. We expected to see some evidence of student growth over time through the mentoring sessions but could not identify it. We concluded that this is because the current set of questions is not suited for the investigation of student growth.

Our results showed that the mentoring activities helped students consider their future. Text mining was a useful technique to analyze answers to open-ended survey questions. In future work, we would like to identify the relationship between numeric indices and the answers to open-ended survey questions. Additionally, we plan to modify the survey questions to better clarify student growth through mentoring.

**Keywords:** P-TECH, Survey, Measurement, Mentoring, Text mining

## Using the SAMR Model as an Enabler to Computer Literacy for Grade 8 to 11 Learners in an Outreach Community Project

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**Abstract.** South Africa is a developing country where students in impoverished schools have limited resources and lack the privilege to access a computing device to enhance their computer literacy skills. Therefore, students are disadvantaged when pursuing a higher education qualification. A university developed an outreach program to help improve student comprehension in the STEM subjects and address computer literacy needs while students are in secondary school before transitioning into tertiary education. In 2021, 431 students registered for the outreach program. However, due to Covid-19 protocols, students could not attend class consistently, which negatively impacted the students' performance at the end of term one. Using an intrinsic case study method, the authors investigated the SAMR model to ensure the program's continued success. In the second term, the program integrated the SAMR model to provide accessibility to the course resources. The online learning provisions allowed the students to complete the course in difficult circumstances, and this implementation improved the students' engagement and performance at the end of term four. Incorporating the SAMR model into the curriculum can be an excellent enabler in enforcing hybrid education for future generations.

**Keywords:** Hybrid Learning, Impoverished, Learning Management System, SAMR, Skills Assessment Manager



## Fostering Students' Resilience – Analyses towards Factors of Individual Resilience in the Computer and Information Literacy Domain

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**Abstract.** In this contribution the resilience of students in the CIL domain is focused. In this context research towards individual student resilience is of relevance in order to examine characteristics from the student level that can be used as setscrews by educators and other educational stakeholder to minimize or overcome social in the CIL domain. Taking advantage of the representative cross-sections of students from the ICILS 2018 study the question of the prevalence of resilient students (research question 1) and their related antecedents and process factors from the ICILS 2018 contextual model (research question 2) have been focused via using a logistic regression approach. Cross country analyses revealed that student's sex and their cultural capital are the strongest predictors for resilience in the CIL domain. However, including family's process characteristics shows that student's self-efficacy toward the use of ICT, their use of ICT for information-related activities itself and the use of ICT for basic and advanced purposes have been identified as significantly related to student resilience.

**Keywords:** student resilience, computer and information literacy, logistic regression, UneS-ICILS 2018.

## Bridging the Learning Gap through Constructivist Teaching and Learning with Technology

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**Abstract.** The COVID-19 pandemic has created a massive disturbance in the education system creating a gap in learning for most students. Prolonged absence from learning due to the lockdowns has led to learners forgetting foundational skills previously learnt. Various different strategies are being adopted by governmental and non-governmental organizations to bridge the learning gap. This paper details one such approach being piloted in government schools in one of the most backward areas of Mumbai, India. The Technology Enabled Learning for Teachers and Adolescents of the 21<sup>st</sup> century (TELTA-21) program aims at bridging the learning gap through the constructivist approach of project-based learning with technology, as opposed to solely relying on bridge courses and remedial lessons.

**Keywords:** Learning Gap, Constructivist Use of Technology, Project-Based Learning with Technology.

## Creating an English Language Education System for High School Students Based on Multiple Intelligences Theory

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**Abstract.** The MI theory was first proposed by Howard Gardner in 1983. This theory is effective to design contents of the curriculum in accordance with each learner's mind characteristics. According to the theory, human mind is a blend of eight intelligences, and each intelligence develops independently of one another. The eight intelligences are: Linguistic, Logical-mathematical, Musical, Bodily-kinesthetic, Visual-spatial, Interpersonal, Intrapersonal, and Naturalist. Since the balance of these strengths varies from individual to individual, the backgrounds, purposes, and learning contents of learners also vary, and it is beneficial to design learning contents according to the intelligence characteristics of learners in educational courses. However, in practice, there is not enough research on how the theory can be used to promote students' learning through ICT. We here propose the development of an English language education system for high school students in Japan based on the theory. Our proposed system provides class contents' models on a tablet screen, which reflect each student's balance of the eight intelligences. The flow of an English class incorporating our system is as follows: i) The system measures balances of the eight intelligences of the students. ii) It shows the measured results to the students and the teacher. iii) The system presents class ideas to the teacher, according to the measured balance of intelligences. iv) With such a system assistance, the teacher sets up contents of the next class. v) During the class, each student implements his/her individual learning on the tablet device. vi) At the end of the class, the students answer to satisfaction questionnaires. vii) The questionnaire results are fed back to the teacher. Herein we focus on policies for creating class contents suitable for each type of multiple intelligences with a typical high-school English language textbook used in Japan based on the ideas of MI-based individualized instructional design.

**Keywords:** Theory of Multiple Intelligences, Educational Technology, Second Language Acquisition.

## The Paradox of Creativity

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**Abstract.** This paper presents a retrospective analysis of a series of story-telling projects, each of which involves online collaborative teaching and learning, in different ways. Each teaching project has been extensively classroom tested, with many examples of students' creative work being presented at educational conferences, published in text books, posted online, or shown on television programmes. The projects have varying cross-curricular elements, and all are based on constructionist principles. The paper attempts to show the pedagogical method, linking a suggested constructionist teaching and learning model (the Paradox of Creativity), and the online and collaborative elements of these projects. Each project is therefore analysed in order to present its three main elements: the use of online teaching and learning materials; collaborative working (including international links); and the restrictions paradoxically imposed on the writing in order to encourage creativity and diversity. This paper has been developed from a brief initial idea, first published a few years ago, but greatly expanded here, with examples of creative work by pupils, which are provided as evidence.

**Key words:** creativity, online teaching and learning, collaboration, paradox

## Twenty Years of Object Orientation A Case Study for North Rhine-Westphalia in Germany

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**Abstract.** About 30 years ago, object orientation (OO) was established as an important technology in software development. There is no doubt that it is a suitable technology for the success of large projects in particular.

With a short time delay, OO also gained access to university education and, a little later, to computer science classes in higher secondary education in Germany. This finally took place with the switch to the Java as first and mostly only programming language. In this process of establishing OO with Java, we have observed some challenges and difficulties over many years. On the one hand, these are due to the educational background of the teachers. On the other hand, difficulties arise from the fact that students must learn two different programming paradigms while using Java. They must understand object-oriented data structuring and imperative-procedural sequence control at the same time. After more than 20 years of experience in higher secondary education, it is time to reflect on these challenges and draw conclusions where appropriate.

**Keywords:** Object Orientation, Curriculum, Secondary Education



## Contribution Title – Please Capitalize the Title as Explained in the Submission Instructions on the Conference Website

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**Abstract.** Following European Union educational policies, the most recent Education Reform in Italy (2016) introduced computational thinking at all school levels. Regrettably, students with intellectual disabilities (ID) appear to be excluded from programming activities with educational robotics (ER). The few existing studies focus mainly on students differing in age and ability. Therefore, this exploratory study aimed to measure the engagement of 8 high school students with ID, aged between 16 and 22, in ER simple programming activities (with Arduino as base), in a school in the North-East of Italy.

Engagement is described as a multi-componential construct, composed by affective, social, cognitive and psychological dimensions, but there seem to be considerable difficulties in measuring the last two. So, we build an ad hoc tool for student engagement with ID. As hypothesized by Champion (2003), it includes multiple measures: an observation grid included the analysis of non-verbal expressive behaviour, inspired by the work of Mehrabian (1968); the transcripts of the verbal comments of the pupils and a questionnaire.

The classroom activity was carried out individually by the pupils. The aim was to program the Rospino© robot's movements (coding), so it would reach the target object, through four paths of increasing difficulty.

The results that emerged from observation matched the answers in the interviews: high involvement in the ER activity, direction of their gaze more than half of the time towards the key object of the activity, facial expressions and body posture in conditions of ease and well-being and frequency of spontaneous tactile contact with the objects demonstrating confidence and interest. Some indicators, as eye contact, number of occurrences and facial expressions, were found to be the most useful: relatively easy to measure, applicable in any context and strongly predictive of the degree of interest and involvement. Others, however, such as facial expressions, body movements and verbal comments, were found to be more related to the context and cognitive abilities or character of the individual guy. The triangulation of the instruments proved to be an indispensable method of detection.

**Keywords:** Engagement, Student with intellectual disability, Educational Robotics.



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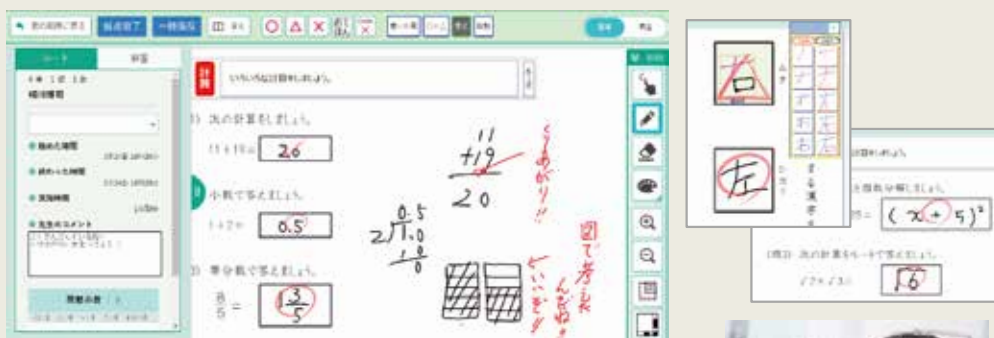


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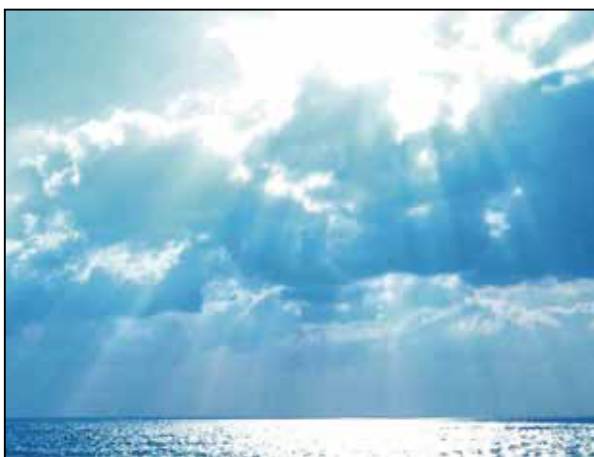
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