캄보디아 ICT 교육

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Study on the Status of ICT in Education Toward Achieving SDG4 2030 Agenda in Cambodia

Phearoun Phel[1], and Ki-Sang Song[2]*

[1]Department of Information Technology, Ministry of Education, Youth and Sport, Cambodia, Deputy Director (phel.phearoun@moeys.gov.kh)*

[2]Department of Computer Education, Korea National University of Education, Professor, (kssong@knue.ac.kr)*

ABSTRACT

The 2030 Agenda for Sustainable Development, agreed upon by all United Nations Member States in 2015, set 17 goals. Number four of these 17 Sustainable Development Goals (SDGs) is Quality Education. Cambodia has embraced the new 2030 Agenda for Sustainable Development and localized the 17 Goals, with the addition of mine action, within the context of the national vision, strategies, and plans for sustainable development. This study intends to investigate the status of ICT in Education in Cambodia for achieving the SDG4 targets. The study uses two methods for data collection: a detailed review of the literature and a survey. For data collection through survey, the Ministry of Education, Youth and Sport (MoEYS) and Ministry of Industry, Science, Technology & Innovation (MISTI) will take part to provide data for capturing different dimensions of alignment; the Integration of ICT into education in terms of achieving the SDG4 in the country. The results will indicate the specific issues and how ICT can be harnessed to strengthen the education system, knowledge dissemination, information access, quality and effective learning, and more efficient service provision.

2015년 모든 UN 회원국이 합의한 지속 가능한 개발을 위한 2030 의제는 17개의 목표를 설정했습니다. 17가지 지속 가능한 개발 목표(SDG) 중 네 번째는 양질의 교육입니다. 캄보디아는 지속 가능한 개발을 위한 새로운 2030 의제를 채택하고 지속 가능한 개발을 위한 국가 비전, 전략 및 계획의 맥락 내에서 광산 활동을 추가하여 17개 목표를 현지화했습니다. 본 연구는 SDG4 목표 달성을 위한 캄보디아 교육정보화 현황을 조사하고자 한다. 이 연구는 데이터 수집을 위해 문헌에 대한 상세한 검토와 설문 조사라는 두 가지 방법을 사용합니다. 설문조사를 통한 데이터 수집을 위해 교육청년체육부(MoEYS)와 산업과학기술혁신부(MISTI)가 참여하여 다양한 차원의 정렬을 캡처하기 위한 데이터를 제공합니다. 국가의 SDG4 달성 측면에서 ICT를 교육에 통합합니다. 결과는 교육 시스템, 지식 보급, 정보 액세스, 품질 및 효과적인 학습, 보다 효율적인 서비스 제공을 강화하기 위해 특정 문제와 ICT를 활용하는 방법을 보여줍니다.

K E Y W O R D S : ICT education, Achieving SDG4, Quality education, Higher education, Teacher Education, General Education, Cambodia

[2*]**Corresponding author:** ***Ki-Sang Song (kssong@knue.ac.kr)***

I. Introduction

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future, with a set of 17 global goals and 169 targets with the unifying thread throughout of commitment to ending poverty [1]. At the World Education Forum 2015, the global community agreed to launch 'Education 2030: the Incheon Declaration and Framework for Action', which seeks to ensure access to basic education for all [3].

Cambodia has embraced the new 2030 Agenda for Sustainable Development and localized the 17 Goals, with the addition of mine action, within the context of the national vision, strategies, and plans for sustainable development.

This paper investigates the status of ICT in Education in Cambodia for achieving the SDG4 targets.

II. Theoretical Backgrounds

Sustainable Development Goal 4 (SDG4) pursues quality lifelong learning for all and highlights the need to harness information and communication technologies (ICT) to achieve the goal by 2030. The SDG4 Framework for Action and the Qingdao Declaration calls for proactive sector-wide strategies to leverage the power of ICT to transform education [2].

The Royal Government of Cambodia (RGC) has pursued a progressive development agenda over the last 20 years. This period has seen recovery from a protracted conflict and genocide, the rebuilding of infrastructure and human resources, and above all, the rebirth of the spirit of the Khmer people. Carrying this forward and continuing MDG achievements, Cambodia enthusiastically supports the Sustainable Development Agenda [5].

Along with other member states, the RGC has been working to adapt the goals to Cambodia's context to craft a fully nationalized framework – the Cambodian SDGs (CSDGs).

In the education context, RGC has begun implementing educational strategies for all, enhancing the quality and effectiveness of educational services, and promoting policies

to increase the capacity of educational institutions capable of developing a skilled workforce. Accordingly, the Ministry of Education, Youth, and Sports of Cambodia have established a five-year educational implementation plan based on three policies: Guaranteeing equal rights and access to education, improving the quality of learning while linking education to national development, and ensuring effective leadership and management of education-related professionals in line with the Royal Government of Cambodia (RGC) Rectangular Strategy Phase 4, National Strategic Development Plan (NSDP) 2019-2023 [7], and SDGs 2030 agenda.

MoEYS also embraced information and communication technology (ICT) for education in 2004. Subsequently, they developed and adopted its first ICT for education Master Plan in 2009 and a newly updated policy and strategy on ICT for education in 2018 [6]. The newly adopted ICT education policy was developed to complement the unimplemented plans of the previous intentions and to better align with the demands of the emerging ICT landscape with increasing demands for ICT applications to support governance and management, research and innovations, knowledge sharing, teaching and learning, and business and industry [13]. The ICT education policy 2018 complements the efforts of the RGC to achieve the 2030 Sustainable Development Goals (SDG).

Even though the political commitment and leadership to adopt ICT was strong, implementing the plan took work, as it depended on the availability of necessary infrastructure and human and financial resources. Furthermore, it recognizes that adopting ICT as a tool in everyday practices requires a cultural shift to understand and accept the new business processes and learning and innovation practices associated with ICT applications in education. This requires long-term vision and continued support for the capacity development of MoEYS personnel to achieve the full benefits of ICT integration. Most ICT for education interventions in MoEYS has been project-based, pilot initiatives, and NGO/community supported, thus lacking systemic design and, consequently, at risk of being unsustainable. Likewise, the outbreak of the Covid-19 pandemic in 2019 has globally and continuously turned down social distancing impacting human communication and resilience of the world as it is speedily and easily transmitted from one person to another. Most academic and social activities have been postponed and canceled, which brought down many policy actions needing to be implemented. At the same time, the priorities turned to supporting the implementation of the urgently developed Covid-19-responded plans in

response to this global crisis. The investment in digital technologies is gaining momentum among enterprises and users alike to adapt to austere measures and seize new opportunities.

Since the adoption of ICT Education policy 2018 and the rapid growth of digital technologies, there has been a sufficient study on the implementation of ICT in education in Cambodia as well as to map the policy's actions toward achieving SDG4 2030 in Cambodia [4].

III. Research Objectives and Methodology

The main goals of the survey are as follows. First, to analyze the current status of ICT in Education to Achieve SDG4 2030 in Cambodia. Second, to provide recommendations for the policy and master plan development toward achieving SDG4 2030 in Cambodia.

All the following questions will be used in this study. First, what are the general aspects of achieving SDG4 2030 and the status of ICT in education in Cambodia? Second, what are the specific issues of integrating ICT in education in relation to ICT policy and the specific targets of SDG4 2030?

The significance of the study consists of the following considerations as follows. First, the research will be the first study that examines the current status of ICT in Education and its aspect for achieving SDG4 2030 at the national level. Second, this study will be the roadmap for ICT in Education in Cambodia and help policymakers improve decision-making and develop more effective national ICT education policies and strategies. Third, proposing recommendations on ICT policy development to reach the Education 2030 Agenda. Fourth, contributing to the national and international knowledge society to make significant decisions on ICT in Education in Cambodia.

The study uses two methods for data collection: a detailed review of the literature and a survey. Responses will be analyzed regarding their integration of ICT into education to assist in achieving SDG4 in the country. The survey will be based on the designed survey by UNESCO, which was used for the "Positioning ICT in Education to Achieve the Education 2030 Agenda in Asia and Pacific" study with the support of Korean Funds-in-Trust in 2018 [8], with some modifications to align with Cambodia context.

IV. Future Research Plan

The approaches of the study are stated as follows.

First, Qualitative and Quantitative approaches will be used as Research Approaches.

Second, for data collection, Secondary and Primary data will be used. For Secondary data, policies, strategies, master plans, and implementation of ICT in Education will be used. For Primary data, interview and survey methods will be used.

Third, the target respondents and sample size is divided into key persons and teachers. For key persons, 10 members of direction levels of MoEYS would involve ICT in Education will be the respondents. For teachers, 500 members who use ICT in teaching and learning will be the respondents.

Fourth, the random and convenience sampling methods will be used as the sampling methods.

Fifth, the qualitative and quantitative approaches will be used for data analysis. The literature review is compared with the study for the qualitative approach. SPSS and Multiple Linear Regression (Predict variable) will be used for the quantitative approach.

References

[1]	UNDES. (2015). Transforming our world: The 2030 agenda for sustainable development. New York, NY: UN Department of Economics and Social Affairs.
[2]	UNESCO. (2015). Incheon declaration and framework for action for the implementation of sustainable development goal 4.
[3]	UNESCO. (2015). Qingdao Declaration: Leveraging ICTs to achieve Education 2030.
[4]	Ministry of Education, Youth, and Sport. (2019). Cambodia's Education 2030 Roadmap Sustainable Development. Phnom Penh: Ministry of Education, Youth and Sport, Cambodia.
[5]	Ministry of Planning. (2019). Cambodia's Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development. Phnom Penh: Ministry of Planning, Cambodia.
[6]	MoEYS. (2018), Policy and Strategy on Information and Communication Technology in Education, Phnom Penh, Kingdom of Cambodia, Ministry of Education, Youth and Sport.
[7]	Royal Government of Cambodia (RGC). (2019). National Strategic Development Plan 2019-2023. Phnom Penh: Royal Government of Cambodia.
[8]	UNESCO. (2018). Positioning ICT in education to achieve the education 2030 agenda in Asia and the Pacific: Recommendations for a regional strategy.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

The Effective use of E-learning in Upper Secondary Schools to Improve Quality and Equity Education

Samphors, UK [1], and Ki-Sang, Song[2*]
[1]Department of Information Technology, Ministry of Education, Youth and Sport, Cambodia, (uk.samphors@gmail.com)
[2]Department of Computer Education, Korea National University of Education, Professor, (kssong@knue.ac.kr)

ABSTRACT

This paper is targeting the Cambodian ICT infrastructure that supports e-learning at the ministry and school levels and introduces the best solution for the current ICT infrastructure situation. Improve the quality of content development and digital material for e-learning and promote e-learning for every school in Cambodia, especially in upper secondary schools. A final report will deliver to the target school and the Ministry of Education, Youth and Sport for improvement.

이 논문은 학교 차원에서 e-러닝을 지원하는 캄보디아 ICT 인프라를 대상으로 현재 ICT 인프라 상황에 가장 적합한 솔루션을 소개한다. e-러닝을 위한 콘텐츠 개발 및 디지털 자료의 품질을 개선하고 캄보디아의 모든 학교, 특히 고등학교에서 e-러닝을 촉진합니다. 최종 보고서는 개선을 위해 대상 학교와 교육청년체육부에 전달됩니다.

K E Y W O R D S: ICT Education, ICT infrastructure, e-learning, u-learning, online learning, Secondary Education, ICT competency.

[2*]**Corresponding author: *Ki-Sang Song (kssong@knue.ac.kr)***

Ⅰ. Introduction

Cambodia is a developing country that just graduated from a Low-Income country to a Middle-Income country in 2015 and trying to putting great effort into moving out of the group of Least Developed Countries (LDC) soon [1]. The Government of the Kingdom of Cambodia has set out its national strategic development plan for 2019-2023 and has set out its medium and long-term development plans to drive Cambodia to be an upper middle-income country in 2030 and a high-income country in 2050 [1]. The Cambodian government also develop the Rectangular Strategy Phase IV, 2018. The first rectangle is mentioned Human Resource Development by strengthening the quality of education, science, and technology. The strategic goal of the Royal government is to develop a “quality, equitable and inclusive education system” by focusing on science and technology, labor market orientation, and physical education to support national socio-economic development to reach its medium and long-term development plan.

The Ministry of Education, Youth and Sport (MoEYS) Strengthening equitable enrollment at all levels, especially basic education in the lessons of the year and organizing school meetings governance learning public release is urgently required as increasing the age for students and poor students. The MoEYS has chosen to pay close attention to improving the quality and responsiveness of education, especially Encouraging teachers and investors, and encouraging all to increase the efficiency and effectiveness of education management. According to the Education Strategic Plan (ESP) 2019-2023, MoEYS must ensure inclusive and equitable quality education and promote life-long learning opportunities for all [3]. In terms of promoting digital education, ICT will be integrated into a tool for teaching and learning and equip students with knowledge and skills on ICT to transition into twenty-first-century employment. MoEYS also use e-learning to support education service delivery to all sub-sectors in education and develop institutional capacity for life-long learning.

As for the addressed problem, the study will look at ICT competency, e-Learning infrastructure, and teachers’ and students’ awareness of e-Learning in high school.

II. Problem Statement

As mentioned in the above section, e-Learning is not new for MoEYS Cambodia. MoEYS has developed policies and strategies using e-learning as an alternative way to implement policies or strategies successfully. MoEYS has developed the e-Learning program called Basic Education Equivalency Program (BEEP) to provide the opportunity for dropout students at lower-secondary schools via an e-learning platform can pursue their studies after completing the program successfully. Relatively, before and during the covid-19, some sample materials, including videos, lesson explanations, and instructional guidance for e-learning, are created and freely accessible throughout MoEYS and its education partnership MoEYS platform and social media such as Facebook Page, YouTube channel, and e-Learning website [4].

Even though e-learning is not a novel phenomenon, educational institutions, teachers, and students are generally not ready for this unexpected disruption to traditional teaching and learning methods. A recent study by Adedoyin and Soykan (2020) points out several concrete challenges caused by the abrupt digital transformation of instructional operations during the COVID-19 pandemic [2]. Key challenges include technological infrastructure and digital competence, socio-economic factors (educational inequality), assessment and supervision, heavy workload, and compatibility. By its nature, e-Learning depends entirely on technological devices and the internet, so it is undeniable that technology is the most pressing challenge to online learning if those involved in the process of teaching and learning are not digitally competent due to inexperience or insufficient training. Some typical technological issues include a lack of knowledge of how to use applications, unstable/slow internet connection, and outdated communication devices. Jalli (2020) argues that the lack of internet access poses great challenges for students in Southeast Asia to study online [5]. In Cambodia, for example, teachers and students, particularly in rural areas, do not have reliable internet access and cannot use emerging technology, making online learning a difficult, if not frustrating, experience for many [6].

III. Literature Review

In an e-learning situation, cyberspace separates the learning provider from the learner. The ability to adapt, realign or change is no longer available. This makes the content block a very crucial block. Given that technology is equal, the content is now the only differentiating factor that separates an effective e-learning initiative from an ineffective e-learning initiative [7].

E-learning (often used interchangeably with online learning) is a form of distance education that involves using technology as the mediator of the learning process. That teaching is entirely delivered through the internet [8]. Depending on individual educational institutions/instructors, students might have to attend regularly scheduled online lectures/presentations and/or discussions. Moreover, students usually access learning materials online, such as recorded lectures/presentations, reading lists, activities, assignments, and so on, through the provided platform. With e-learning, students submit their work and receive feedback online. Students can also connect and interact with their peers online. Sometimes, they can be together in an online class with an instructor while working through their digital lessons, materials, or assessments [9].

With a comparable characteristic, distance learning has the same structure as learning. Siemens et al. (2015) defined distance learning as “teaching and planning to learn where the teaching occurs in a different place from learning, requiring communication through technologies and special institutional organization.” Distance learning is simply an effort to provide access to learning for geographically distant people.

Blended learning (also known as hybrid learning) refers to the practices that combine (or blend) traditional face-to-face classroom instruction with online learning [8].

As the above definitions suggest, e-learning, online, and distance learning are almost the same, and blended learning is not entirely distinct. According to Pearson (2020), online learning involves an online learning environment, while blended learning is a mixture of both face-to-face and online learning.

IV. Methodology

This research will use a quantitative research method. The sample will be randomly selected from upper secondary resources schools (USRS). One USRS from each twenty-five provinces and one capital city. The participant will be selected from teachers and students in six subjects (Mathematics, Biology, Chemistry, Physic, Earth Science, and ICT) from grades 10 to 12. The data will be collected, including pre/post-test and questionnaires to randomly selected participants. The questionnaires consist of three questions: 1-Personal information including study background and professional development. 2-Digital literacy skills include computer literacy skills and mobile technology skills. 3-The awareness of using E-Learning for teaching and learning from teachers and students. In addition, it will also collect data on the understanding of ICT and pedagogy skills and digital education performance.

References

[1]	Royal Government of Cambodia (RGC). (2019). National Strategic Development Plan 2019–2023.
[2]	Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. Interactive learning environments, 1-13.
[3]	Department, P. (n.d.). Education strategic plan 2019-2023. ទំព័រដើម. Retrieved October 10, 2022, from http://www.moeys.gov.kh/index.php/en/policies-and-strategies/3206.html
[4]	Heng, K., Sol, K., Kaing, S., & Ros, V. (2020). 23. Conclusion: Key challenges in working with novice Cambodian writers and researchers. Edited by Kimkong Heng Sopheap Kaing Vutha Ros Koemhong Sol, 125.
[5]	Jalli, N. (2020). Lack of internet access in Southeast Asia poses challenges for students to study online amid COVID-19 pandemic. The Conversation, 17.
[6]	Flynn, G., & Himel, J. (2020). School closures highlight inequality in education as classes move online. Cambodianess. March, 23, 2020.
[7]	Hamid, A. A. (2001). E-learning. The Internet and Higher Education, 4(3-4), 311–316. https://doi.org/10.1016/s1096-7516(01)00072-0
[8]	Siemens, G. (2015). Preparing for the digital university: A review of the history and current state of distance, blended, and online learning.
[9]	Stauffer, A. (2020). A World of Fiction: Digital Collections and the Future of Literary History by Katherine Bode. Victorian Studies, 62(3), 546-547.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Data Communication and Computer Network Textbook for ICT Pre-service Teachers In Case of Cambodia

Thuy, Miech [1], and Ki-Sang, Song[2]*
[1]Department of Computer Education, Korea National University of Education, Graduate Student, (miech.thuy.hs@moeys.gov.kh)
[2]Department of Computer Education, Korea National University of Education, Professor, (kssong@knue.ac.kr)

ABSTRACT

Studying Data communication and computer networking is a great need in Cambodia, especially for pre-service teachers who May work as teachers in secondary schools. This study aims to write the Data Communication Textbook, including communication, data, and computer study book to teach students who are studying to be teachers before serving. The Developed Communication textbook has 8 chapters and 11 practices, all of which are important for teaching students in lessons related to network and network security. Some teaching materials, such as a packet tracer, Ubuntu server, UTP, STP cable, etc., are required to teach this subject better. With this study, The Developed Communication book would help students in Cambodia to advance in information technology.

데이터 통신 및 컴퓨터 네트워킹을 공부하는 것은 특히 중등학교에서 교사로 일할 예비 교사들에게 캄보디아에서는 매우 필요합니다. 본 연구는 교원이 되기 위해 공부하는 학생들이 교사 임용 전에 이를 가르치기 위해 통신, 데이터, 컴퓨터 학습서를 포함한 데이터 통신 교과서를 집필하는 것을 목표로 합니다. 개발된 통신 교과서는 8개 장과 11개 실습으로 구성되어 있으며 모두 네트워크 및 네트워크 보안과 관련된 수업에서 학생들을 가르치는 데 중요한 내용입니다. 이 주제를 더 잘 가르치려면 패킷 추적기, 우분투 서버, UTP, STP 케이블 등과 같은 일부 교재가 필요합니다. 이 연구를 통해 개발된 커뮤니케이션 책은 캄보디아 예비교사들이 정보 기술을 습득하는 데 도움이 될 것입니다.

K E Y W O R D S: Data Communication, Computer Networks, Textbook Development, Lower Secondary Education, Teacher Education

[2]***Corresponding author:** ***Ki-Sang Song (kssong@knue.ac.kr)***

I. Introduction

Human beings are the only creatures on the earth who can communicate with each other through the medium of language. But humans take this gift to another extent. Distance, time, and physical existence of the person don't matter in communication these days because they build a communication system through which they can communicate or share data like images, videos, text, files, etc., with their loved ones anytime, anywhere. Communication is a process in which more than one computer transfers information and instructions to each other and for sharing resources. Or in other words, communication is a process or act in which we can send or receive data. A network of computers is defined as an interconnected collection of autonomous computers.

Data communications refer to transmitting this digital data between two or more computers. A computer network or data network is a telecommunications network that allows computers to exchange data. Networked computing devices' physical connection is established using cable or wireless media. The best-known computer network is the Internet.

Therefore, Cambodia's Teacher Education System needs to develop a proper ICT curriculum and textbooks to respond to the rapidly changing social context, such as the Fourth Industrial Revolution.

In this study, the basics of the Data Communication and Computer Networks textbook are developed, including various advanced concepts related to Data Communication and Computer Networks.

II. Data Communication and computer network Curriculum for Pre-service Teacher

In Cambodian ICT curriculum for data communication and computer network hours are assigned 22, 20, and 18 hours for each grade as follows.

Tab.1 Data communication and computer network Curriculum

Content	Hour	
Chapter 1 Introduction to Data Communication	5	45
Chapter 2 Type of Computer Network	5	
Chapter 3 Information Transmission Types and Transmission Media	5	
Chapter 4 Data Link Layer	5	
Chapter 5 Network Model	4	
Chapter 6 Network Layer	6	
Chapter 7 Transport Layer	5	
Chapter 8 Network Security	10	

III. Data Communication and Computer Network Textbook Development

The pre-service teacher component of the course focuses on practice for data communication and computer networking, and we focus on practice, including motivation, keywords, practice content, and questions.

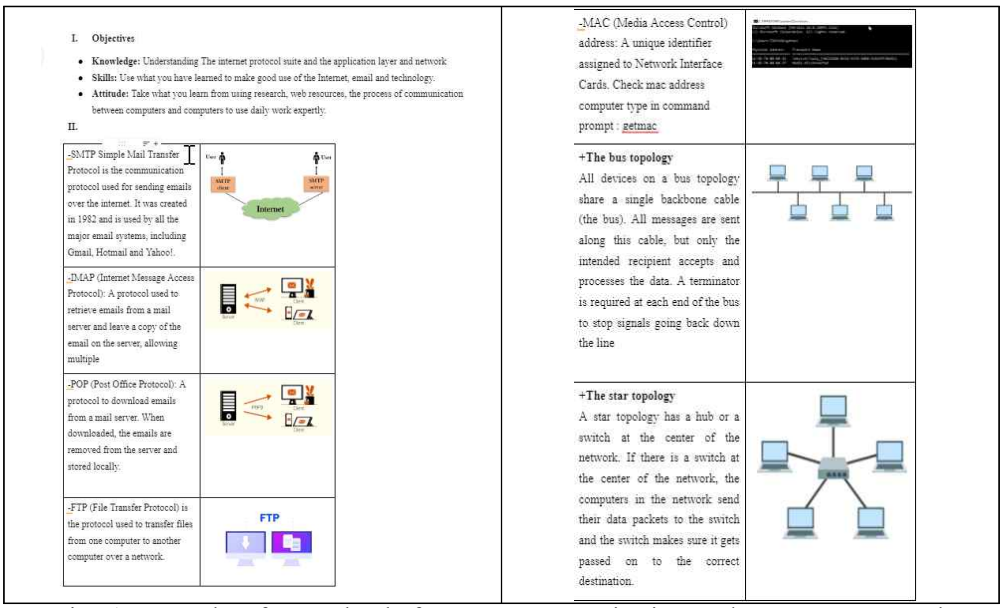
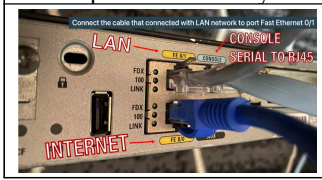
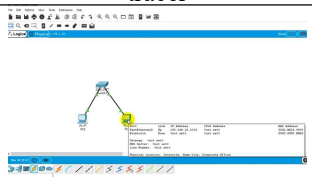
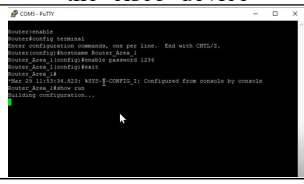


Fig. 1 Example of a textbook for Data communication and computer network

IV. The Flow of Teaching and Learning for Data Communication and Computer Network

Here is how teaching and learning may. Before using Packet Tracer, students view a video and understand its principles. Students learn how to set up an implementation process in student-centered networking. Second, they get some practice looking up extra network management classes utilizing websites or mobile apps. Additionally, the instructor began allowing direct Packet Tracer practice for the students.

Tab.2 The Flow of Teaching and Learning

Watch the video and explain the theory	Practice using the Packet tracer	Configure with putty on the cisco device
		

V. Conclusions

The Developed Data communication and computer networking textbook will quickly become a textbook for RTTC students, and this book will be the guideline for students in the future. After that, it will be shared knowledge in this book online, such as videos, images, text, documents, game diagrams, and practice. Questions to fit the topic of teaching. Through this, students can learn effectively and efficiently online and offline.

References

[1]	Forouzan, B. A. (2007). Data communications and networking. Huga Media.
[2]	Online: https://www.tutorialspoint.com/data_communication_computer_network/index.htm
[3]	https://www.cisco.com/c/en/us/support/docs/ios-nx-os-software/ios-software-releases-110/45843-configpasswords.html
[4]	https://ubuntu.com/tutorials/install-ubuntu-server#1-overview
[5]	https://asecuritysite.com/encryption/des
[6]	https://asecuritysite.com/encryption/rsa

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Data Analysis in Database textbook for Pre-Service Teacher Education: In the Case of Cambodia

Phal, Phin [1], and Tae Young, Kim[2*]
[1]*Department of Computer Education, Kandal Regional Teacher Training Center, Teacher Educator, (pin.phal.rttc@moeys.gov.kh)*
[2]*Department of Computer Education, Korea National University of Education, Professor,(tykim@knue.ac.kr)*

ABSTRACT

Data has increased quickly in modern technology, such as the fourth industrial revolution. Due to the large and complex collection of the dataset is difficult to process on the traditional data processing application. So that led to reaching a new technology called Data Analysis. Many tools, such as weka, R, orange, etc., are used to analyze and visualize using data mining. Through the textbook, we have attempted data mining tools, especially orange 3, for pre-service teachers can learn effectively online and offline to analyze data.

4차 산업혁명과 같은 현대 기술에서 데이터는 빠르게 증가했습니다. 데이터 세트의 크고 복잡한 컬렉션으로 인해 기존의 데이터 처리 애플리케이션에서 처리하기 어렵습니다. 그래서 데이터 분석이라는 새로운 기술에 도달했습니다. weka, R, orange 등과 같은 많은 도구가 데이터 마이닝을 사용하여 분석하고 시각화하는 데 사용됩니다. 교과서를 통해 예비교사들이 온라인과 오프라인에서 데이터 분석을 효과적으로 학습할 수 있도록 데이터마이닝 도구 중에서 특히 *orange 3*를 중심으로 학습하였습니다.

K E Y W O R D S: Data Visualization, Data mining, orange, pre-processing.

[2*]**Corresponding author:** ***Tae Young Kim (tykim@knue.ac.kr)***

Ⅰ. Introduction

Data Analysis performs three major operations cleansing, transforming, and modeling data. However, there are various tools for data mining to perform data visualization, analysis, and extraction. Comparison of some tools along with parameters and features and decided to use for analysis [1].

Data analysis includes open-source data tools, data visualization tools, sentimental tools, data extraction tools, and databases. These tools generate a report to summarize the conclusions, provide better visualizations, and produce accurate results with minimum effort [2].

Data analysis is essential to data mining and Business Intelligence (BI). Data mining tool such as Orange is used to analyze as well. Orange is a perfect software suite for machine learning and data mining. It is useful for visual programming and explorative data analysis. It is written in python and has multiple components known as widgets. Data mining tool supports macOS, Windows, and Linux [3].

This study intends to build the Data Analysis in a Database textbook for Pre-Service Teacher Education in Cambodia that the Korea International Cooperation Agency supports ICT curriculum development projects to expand ICT capabilities, particularly for pre-service teachers in Cambodia.

Ⅱ. Core Concepts of the Subject

Orange provides data visualization and analysis for novices and experts; through interactive workflows. The File widget will now read the famous data set on the iris flower dataset and send it to the workflow. The changes will be useful through the workflow updating its appliance. [2].

The CSV File Import widget reads comma-separated files and sends the dataset to its output channel. File separators can be commas, semicolons, spaces, tabs, or manually-defined delimiters. [4].

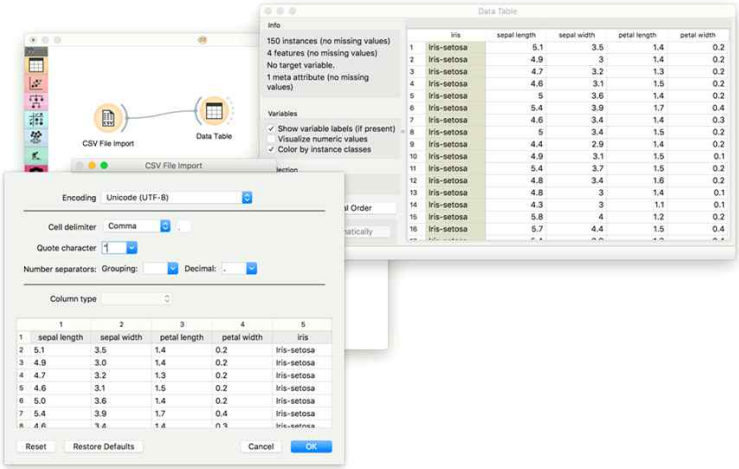


Fig. 1 Example of a textbook for ICT for using CSV File and Data Table

We can visualize the pre-processed data in simple graphs that can be visualized using the box plot graph [2].

Fig. 2 Example of a textbook for ICT for using box plot widget in visualization

Scatter plot visualization with exploratory analysis and intelligent data visualization enhancements [4].

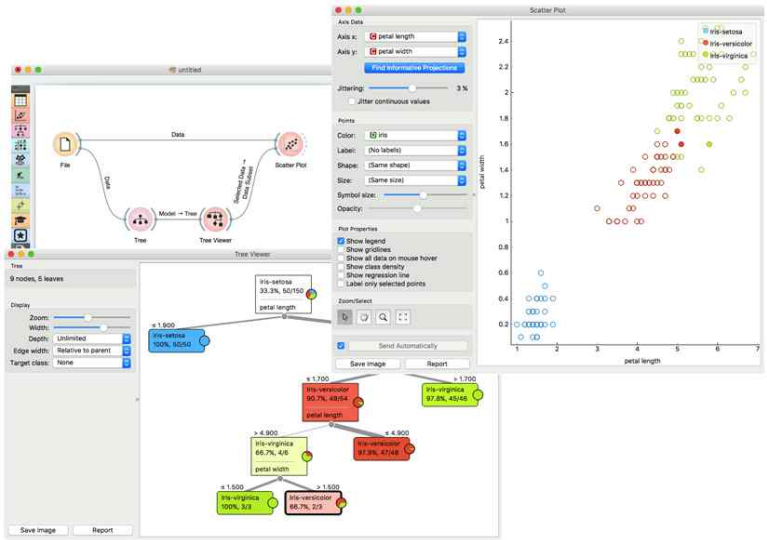


Fig. 3 Example of a textbook for ICT for using scatter plot widget in visualization

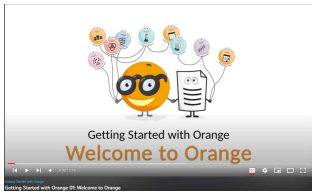
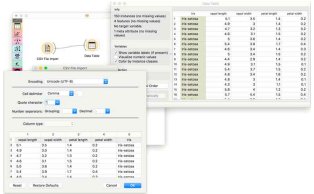
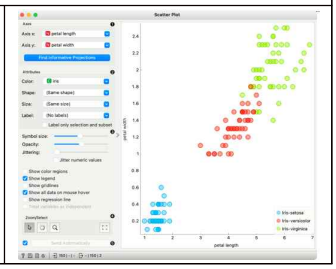
Ⅲ. Subject Textbook Development for ICT Teacher Educator

The Data analysis is one of the parts in the Database subject textbook for pre-service teachers to teach and learn. It focuses on the data process and visualization through the Orange 3 tool. First, it guides the lesson's title and the lesson objectives. Second, data analysis is focused on theory and practice, consisting of motivation, key points, summary, question, exercise, and practice problems for conducting practice.

Ⅳ. How to implement the Textbook

How of teaching and learning for data analysis in the database subject textbook. First, pre-service teachers watch the video and explain the theory about data process and visualization through the usage widget on the Orange 3 tool. Pre-service teachers learned in this part. Second, pre-service teachers practice using the computer (combining each widget to analyze data through the Orange 3 tool.). Students can analyze data to solve problems, such as the result of student information, income, expanse report, etc., related to what they have learned and implement it by analyzing data after they understand how to use widgets in the Orange 3 tool.

Tab.1 The Flow of Teaching and Learning

Watch the video and explain the theory	Practice using the Orange tool By focusing on Data processes and Data visualization	
		

V. Conclusions

Data Analysis in the Database subject textbooks will be developed and used to be useful to pre-service teachers. Data Analysis in this subject focused on Data process and Data visualization through the Orange 3 tool to analyze data. Orange has performed well and is easy to use. Moreover, Orange has done everything after practical implementation, as its features are shown. Therefore, this tool makes analysis work easier. Through study from this textbook at the regional teacher training center (RTTC), the pre-service teachers will be able to have full capacity to teach students at lower secondary schools.

References

[1]	Kukasvadiya, M. S., & Divecha, N. H. (2017). Analysis of data using data mining tool orange. International Journal of Engineering Development and Research, 5(2), 1836-1840.
[2]	Pynam, V., Spanadna, R. R., & Srikanth, K. (2018). An extensive study of data analysis tools (rapid miner, weka, r tool, knime, orange). Int. J. Comput. Sci. Eng., 5(9), 4-11.
[3]	Padmavaty, V., Geetha, C., & Priya, N. (2020). Analysis of data mining tool Orange. International Journal of Modern Agriculture, 9(4), 1146-1150.
[4]	Online: https://orangedatamining.com/

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Database Textbook for ICT Pre-service Teacher: In Case of Cambodia

Rithy, Sorn[1], and Tae-Young, Kim*[2]
[1]Department of Computer Education, Korea National University of Education, Graduate Student, (rithy.sorn12@gmail.com)

[2]Department of Computer Education, Korea National University of Education, Professor, (tykim@knue.ac.kr)

ABSTRACT

This paper presents a Database, including Computer Science, Technology, and Mathematics, for Storing information or data for easy access, management, and Updating. This study explores how to use computer science and technology for data management for pre-service teachers, especially to enhance the overall quality of education. This study shows the important benefit of using ICT with the Database curriculum to achieve these goals. It also presents theories and best practices for effective data management methods among pre-service teachers. Finally, we hope that technology learning will increase the level of understanding quickly and develop good knowledge.

이 백서에서는 쉬운 액세스, 관리 및 업데이트를 위해 정보 또는 데이터를 저장하기 위한 컴퓨터 과학, 기술 및 수학을 포함한 데이터베이스를 제시합니다. 이 연구는 특히 교육의 전반적인 품질을 향상시키기 위해 예비 교사의 데이터 관리에 컴퓨터 과학 및 기술을 사용하는 방법을 탐구합니다. 이 연구는 이러한 목표를 달성하기 위해 데이터베이스 커리큘럼과 함께 ICT 를 사용하는 중요한 이점을 보여줍니다. 또한, 예비 교사들 사이에서 효과적인 데이터 관리 방법에 대한 이론과 모범 사례를 제시합니다. 마지막으로 기술 학습을 통해 이해도가 빠르게 높아지고 좋은 지식이 쌓이길 바랍니다.

K E Y W O R D S: ICT Education, Teacher Education, Database, SQL, MYSQL, PHP

[2]***Corresponding author:** ***Tae Young, Kim** (tykim@knue.ac.kr)*

Ⅰ. Introduction

Databases are used everywhere to store information. Whether in a customer management system or tracking bank information, databases store the necessary data for later use [1]. Data is structured in rows and columns featuring different fields for queries and stored in multiple tables to showcase their relations. Thus, the Pre-service teacher understood the theoretical meaning of database by implementing SQL, MySQL, and PHP. Finally, it will provide important knowledge and modern teaching methods to the effective Pre-service teacher.

This paper discusses the concept of the database for teaching pre-service teachers. It explores technology-based teaching, in particular, learning data management scientifically. It identifies some existing programs and the technology to help teachers provide meaningful and effective Database curriculum.

Ⅱ. Core Concepts of Database Subject

The database curriculum is designed to empower the pre-service teacher to explore using technology for data management [2]. The curriculum focuses on the teacher's teaching in the classroom with the fundamental concepts of data modeling, design, and query development in a relational database. The basics of databases and also integrated SQL (Structured Query Language). It is often the default tool for "operating" on the conventional database to alter tabled data, retrieve data, or otherwise manipulate an existing data set. Also included in the lesson is the PHP MySQL Database. We can use PHP combined with MySQL for Create, Update, Select, and Delete commands that allow handling the information using tables in the database [3].

Ⅲ. Database for ICT Pre-service Teacher

Regional Teacher Training Centers (RTTC) are divided into two programs related to ICT subjects. Firstly, teacher trainees who chose ICT as the first subject and English as the second subject called (ICT-ENG). Secondly, teacher trainees who chose English as the first subject and ICT as a second subject called (ENG-ICT).

There are slightly different curricula among both two programs. According to the Reginal Teacher Training Center curriculum, the database teaches ICT-ENG and ENG-ICT major trainees. The Database subject should contain as below:

Introduction to database and database systems: This chapter will contain the general concept, history, file system, relational database, and DBMS structure.

Relational Model: This chapter is dedicated to the relational model used since the late 1970s by E.F. Codd (Edgar Frank Codd). Various operations in relational algebra and relational calculus are given in this chapter.

Relational Language-SQL: this chapter introduces the history of SQL and Relational language-SQL. It will provide the definition, theory, and how to use Relational language-SQL to create, modify, retrieve and manipulate data from relational database management systems, such as the history of SQL, data definition language, data modification, and embedded SQL.

Entity-Relationship Model: this chapter is to introduce about Entity-Relational Model. It will provide a graphical representation that depicts relationships among people, objects, places, concepts, or events within an information technology (IT) system.

SQL: This chapter is to practice about most common command types in SQL. It will provide you with the practice for Create, Alter, Drop, Read, Update and Delete commands and allows you to handle the information using tables in a database.

PHP: This chapter aims to introduce Web Server (httpd), PHP My SQL, install and configure Web Server (Apache), and PHP My SQL on Windows 10. It will provide a basic understanding and practice of Web Server (httpd), PHP, and My SQL, install and configure Web Server (httpd), PHP My SQL. This chapter will explain to you some PHP My SQL for Create, Update, Select, and Delete commands that allows handling the information using tables in the database.

Ⅳ. How to implement Database Textbook

Database subjects will have three ICT-ENG credits and two ENG-ICT credits. It teaches only one semester and has three hours per week. The teaching style will be divided into two parts, lecture for two hours and practice for one hour.

The database will use My SQL, PHP, HTML5, notepad, and as the computer application, MySQL Workbench, web server, and web application for study and real-time practice.

The teaching methodology should use Project Base Learning (PBL). All students must create their projects individually, in pairs, or small groups after finishing the class successfully.

Ⅴ. Conclusions

In this study, the textbook for the database is developed by integrating technology into our curriculum. The database is the foundation of structuring data. Database is necessary to hold and manage user data and other personal information. As computers and other technology were introduced, managing and storing data in the DBMS became much more straightforward. The database has many advantages, including efficiency, versatility, categorization, and organization, to name a few. In addition to teaching databases and data, the analysis subject is significant for pre-service teachers to become lower secondary school teachers and pursue their studies to get a bachelor's degree in Information Technology.

References

[1]	Conger, S. (2012). Hands-on database: an introduction to database design and development. Prentice Hall.
[2]	Silberschatz, A., Korth, H. F., & Sudarshan, S. (2002). Database system concepts (Vol. 5). New York: McGraw-Hill.
[3]	Online: https://www.w3schools.com/php/php_mysql_intro.asp

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of STEAM Education based on ICT for Pre-service Teacher: In Case of Cambodia

Sokchea, LAY*[1], and Young-Sik, Kim[2]
[1]Department of Computer Education, Korea National University of Education, Graduate Student, (lay.sokchea.rttc@moeys.gov.kh)
[2]Department of Computer Education, Korea National University of Education, Professor, (kimys@knue.ac.kr)

ABSTRACT

This paper presents a STEAM (Science, Technology, Engineering, Arts, and Mathematics) Education model that leverages Information and Communications Technology (ICT). This paper explores how technology-driven strategies can increase teacher trainees' engagement in learning and enhance the overall quality of education. To achieve these goals, this paper discusses the importance of leveraging ICT within the context of a STEAM curriculum. It also outlines best practices for designing an effective ICT-based STEAM program that encourages creativity and innovation among teacher trainees. Finally, it explores the implications of integrating ICT into the STEAM education program and provides practical suggestions for making such an integration successful.

이 백서에서는 정보 통신 기술(ICT)을 활용하는 STEAM(과학, 기술, 엔지니어링, 예술 및 수학) 교육 모델을 제시합니다. 이 백서에서는 기술 중심 전략이 어떻게 교사 연수생의 학습 참여를 높이고 전반적인 교육 품질을 향상시킬 수 있는지 살펴봅니다. 이러한 목표를 달성하기 위해 이 백서에서는 STEAM 커리큘럼의 맥락에서 ICT 활용의 중요성에 대해 논의합니다. 또한 교사 연수생의 창의성과 혁신을 장려하는 효과적인 ICT 기반 STEAM 프로그램을 설계하기 위한 모범 사례를 설명합니다. 마지막으로 ICT를 STEAM 교육 프로그램에 통합하는 것의 의미를 탐구하고 그러한 통합을 성공적으로 만들기 위한 실용적인 제안을 제공합니다.

K E Y W O R D S: ICT Education, STEAM Education, Convergence Education, Robotics Education,

[2]***Corresponding author:** ***Kim Young Sik (kimys@knue.ac.kr)***

Ⅰ. Introduction

This paper discusses the concept of STEAM education based on Information and Communications Technology (ICT). The paper explores the role of ICT in integrating the various components of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education. It identifies some existing applications that use ICT to help teachers deliver a meaningful and effective STEAM curriculum. In addition, it looks at ways to create innovative learning opportunities through online platforms. Finally, it suggests strategies for incorporating ICT-based instruction into traditional teaching methods. The paper concludes with recommendations on how to use ICT to support a comprehensive approach to STEAM education.

STEAM education has gained more and more attention in recent years as an innovative approach to learning that prepares teacher trainees with the necessary skills and knowledge for their future careers. With the use of ICT (Information and Communications Technologies), STEAM-based education has become increasingly accessible for teacher trainees of all ages around the world. This paper aims to explore the benefits of STEAM-based education on ICT and analyze how this type of learning can foster creativity, develop problem-solving skills, and promote critical thinking among teacher trainees [1]. Additionally, it will discuss potential challenges associated with integrating ICT into STEAM-based teaching methods. Finally, it will provide suggestions for implementing STEAM-based ICT education programs to achieve successful outcomes for both teacher trainees and teachers.

Ⅱ. Core Concepts of STEAM Education based on ICT

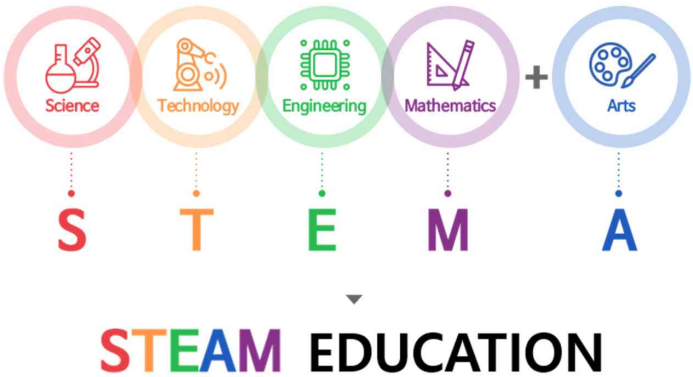
This STEAM-based curriculum empowers teacher trainees to explore the impact of information and communication technology (ICT) on Science, Technology, Engineering, Arts, and Mathematics (STEAM) education. Through this curriculum, teacher trainees will understand the connections between ICT and the various disciplines that make up STEAM education. The curriculum focuses on developing an appreciation for how ICT can be used to design innovative solutions to real-world problems while inspiring critical thinking, creativity, and collaboration among peers [2].

The curriculum for STEAM Education based on ICT focuses on Science, Technology, Engineering, Arts, and Mathematics, integrating Information and Communication Technologies (ICTs) in the learning process. This approach encourages teacher trainees to think critically and creatively, acquire new skills and develop their understanding of various subjects in an engaging manner.

Ⅲ. STEAM Education based on ICT for the pre-service teacher

This textbook aims to teach teacher trainees how Science, Technology, Engineering, Arts, and Mathematics (STEAM) intersect and are used to drive innovation in the modern world. Teacher trainees will learn to use ICT tools and resources such as computers, the internet, multimedia tools, and coding platforms to explore these concepts in a meaningful way. Teacher trainees will learn how to create solutions for current global challenges through hands-on activities, simulations, and real-world applications.

Lessons in this textbook will cover topics as follows. First. Introduction to STEAM education explores the Concept and Definition of STEAM fundamentals



Second, Robotics and Artificial Intelligence introduce algorithms and building robots with LEGO Mindstorms EV3

These topics will be integrated throughout the course through interactive projects that encourage collaboration amongst peers and a sense of discovery when developing solutions for problems. The overall goal is for teacher trainees to gain knowledge and skills in STEAM based on ICT tools so that they may contribute to future innovations within their community or around the world [3].

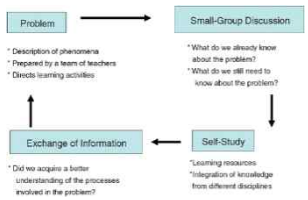
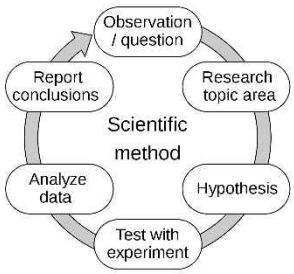
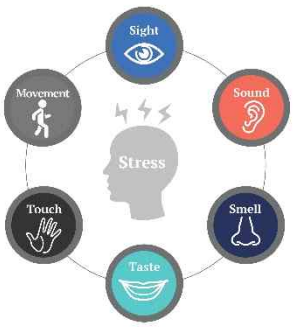
Fig. 3.3 EV3 software interface

Ⅳ. How to implement STEAM Education Based on ICT

Teacher trainees will be assessed on their progress throughout the course by examining their completed projects and workbooks, which document their efforts and achievements in each activity. At the end of the course, an assessment will include practical assessments of individual teacher trainees' performance and written tests covering the content taught throughout the program. The grading system should also allow for self-assessment whereby teacher trainees can gauge their mastery of the material covered during the course.

The flow of teaching and learning is as follows. First, the Introduction part introduces teacher trainees to the fundamentals of ICT, such as coding, data analytics, robotics, and machine learning. Second, the Theory part teaches each topic's theoretical aspects and encourages critical thinking using examples and discussions. Third, the Experimentation part provides teacher trainees with hands-on experiences with ICT-related activities that are engaging and help to solidify their understanding of the theory being taught. Forth, the Application part lets teacher trainees explore ways to apply their newly acquired skills in practical projects related to science, technology, engineering, arts, and mathematics (STEAM). Fifth, the Reflection part allows teacher trainees to take a step back from the project and reflect on what was learned to gain deeper insights into how their skills may be applied in real-world scenarios.

Tab.1 The Flow of Teaching and Learning

Step 1: 'Presentation of Situations' to Let teacher trainees Recognize Problems as Their Issue	Step 2: 'Creative Design' for Discovering How to Solve the Problem on One's Own	Step 3: 'Emotional Touch' for Challenging a New Problem
		

Introduction to STEAM introduces teacher trainees to the core principles and values of STEAM Education, such as creativity, problem-solving collaboration, innovation, and exploration. Introduce teacher trainees to basic information and communication technology (ICT) concepts and how these can be applied in a STEAM setting.

Inquiry-Based Learning engages teacher trainees in inquiry-based activities where they explore ICT concepts through hands-on projects that allow them to develop their understanding of the topic. Incorporate project-based learning approaches that integrate ICT topics with traditional classroom instruction to foster deeper understanding and encourage real-world applications.

Technology Integration uses technology integration strategies to ensure the effective use of ICT resources and platforms throughout the curriculum so that teacher trainees can access a wide range of materials that help further their learning objectives.

Collaborative Problem Solving teaches teacher trainees the value of collaborative problem solving by having them work together on projects or challenges involving ICT tools and resources.

Assessments & Evaluation utilizes assessments and evaluation methods such as portfolios, teacher trainees surveys, rubrics, and digital tracking tools to monitor teacher trainees' progress in mastering ICT skills and overall STEAM education goals.

Ⅴ. Conclusions

Cambodia's RTTC education ICT textbooks, which will be developed and used in the future, we can develop textbooks for STEAM Education based on ICT by integrating technology into our curriculum. This can include introducing teacher trainees to computer programming and software, teaching them how to use ICT in the classroom, and showing them how to use different applications. We could also include hands-on activities related to various aspects of STEAM, such as building robots or creating 3D designs. Furthermore, we can integrate digital content from online sources like YouTube and Khan Academy, making the curriculum more dynamic and interactive. Ultimately, this type of textbook development can help promote a better understanding of the technologies associated with STEAM education and help prepare teacher trainees for success in today's modern world.

References

[1]	Jaime E. Martinez (2017). The Search for Methods in STEAM Education
[2]	Dr. Casey H. Rawson (2019). Picking up STEAM: Science, Technology, Engineering, Arts, and Mathematics Instruction in the Public Library
[3]	Online: publiclibraryinstruction.web.unc.edu.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Python Programming Textbook for Pre-Service Teacher Education: In Case of Cambodia

Chea, Sok[1], and Kwan Hee, Yoo[2]*
[1]*Department of Computer Education, Korea National University of Education, Graduate Student, (itsokchea@gmail.com)*

[2]*School of Computer Science, Chungbuk National University, Professor, (khyoo@chnu.ac.kr)*

ABSTRACT

Software is all around us, even in the device we are using. Python is a computer programming language for readability and functionality. In this paper, The Python programming textbook is developed for ICT pre-service teachers in Cambodia to emphasize expanding ICT capabilities, particularly in Cambodia. Python Programming Textbook provides the student with many technical and professional skills. In each part of each chapter, there are Key Points that are important to note or remember. The main point has some explanation paragraphs. The teacher will use the knowledge that they have learned with experiences to teach them. They will learn effectively and efficiently for use in their life.

소프트웨어는 우리 주변 어디에나 있으며, 우리가 사용하는 장치에도 있습니다. Python은 가독성과 기능을 위한 컴퓨터 프로그래밍 언어입니다. 본 논문에서는 특히 캄보디아에서의 ICT 역량 확대를 강조하기 위해 캄보디아의 ICT 예비 교사들을 위해 Python 프로그래밍 교재를 개발하였다. Python 프로그래밍 교과서는 학생에게 많은 기술 및 전문 기술을 제공합니다. 각 장의 각 부분에는 주목하거나 기억해야 할 중요한 요점이 있습니다. 요점은 몇 가지 설명 단락이 있습니다. 교사는 경험을 통해 배운 지식을 사용하여 가르칠 것입니다. 그들은 삶에서 사용하기 위해 효과적이고 효율적으로 배울 것입니다.

K E Y W O R D S : Python Programming, Computational Thinking, Data Structure, Data Science, Algorithm

[2]***Corresponding author: Kwan Hee, Yoo (khyoo@cbnu.ac.kr)**

I. Introduction

Software is all around us, even in the device we are using. There is plenty of it to control all those devices [1]. Of course, we expect to find and use the software on our personal computers, but the software also plays a role in running airplanes, cars, cell phones, cookers, and even a toaster needs software. On a personal computer, we use a word processor to write documents, a web browser to browse the Internet, and an email client to send messages. Programmers create programs with the help of powerful tools called programming languages.

Python is a computer programming language for readability and functionality [2]. One of Python's design goals is that the meaning of the code is easily understood because of the very clear syntax of the language. The Python programming language has a specific syntax (form) and semantics (meaning) that enables it to express computations and data manipulations that a computer can perform. Python is a programming language that is simple, easy to learn, free and open source, portable, interpreted, object-oriented, extensible, embeddable, and extensive library [3-5].

So, In this paper, The Python programming textbook is developed for ICT pre-service teachers in Cambodia to emphasize expanding ICT capabilities, particularly in Cambodia.

II. Core Concepts of the Python Programming Subject

Python Programming has 17 chapters. It separates four parts. The first part has two chapters (1 & 2): it talks about introduction to computers and programming (algorithm) and computational thinking with programming. The second part has five chapters (3-8): it talks about basic Python Programming. The third part has three chapters (9-12): it talks about Data Structure in Python. The fourth part has two chapters (13 & 14): it talks about GUI Programming and Database. The fifth part has a chapter (15-17) about Data Science & Analysis [6-7].

Tab.1 Contents and Main Points for Python Programming

Contents	Main Points
Chapter 1: Introduction to computer programming 1. Introduction 2. Characteristics of a good program 3. Problem-solving techniques in the computer programming **Chapter 2: Computational Thinking and Programming** 1. What is Computational Thinking? 2. The four cornerstones of Computational Thinking 3. Examples of Computational Thinking 4. Teaching Computational Thinking to Everyone Using Computational Thinking in Python Programming	it talks about introduction to computers and programming (algorithm) and computational thinking with programming
Chapter 3: Introduction to Python 1. Introduction to Python 2. Features of Python 3. Applications Developed by Python 4. Strengths and Weaknesses of Python 5. Installing Python 6. Running Python 7. Program Errors **Chapter 4: Variables and Data Types** 1. Variables 2. Data Types 3. Types of Python Operators 4. Operator Precedence 5. Type Conversion 6. Input () Function **Chapter 5: Conditional Statements** 1. Conditional Statements 2. Relational Operators 3. Ternary Operators 4. Logical Operators 5. Membership Operators **Chapter 6: Loop Statements** 1. Control Statement 2. Types of Iterations 3. What is a List? 4. For Loop Statement 5. While Loop Statement 6. Nest Loop Statement **Chapter 7: Functions** 1. Functions	It talks about basic Python Programming.

Contents	Main Points
2. Write and Call Functions 3. Why do we use Functions? 4. Recursion Call 5. Range of Variables in a Function **Chapter 8: Objects & Class** 1. Object-Oriented Programming 2. Information Hiding 3. Inheritance	
Chapter 9: Data Structures in Python 1. Introduction 2. Data Structures in Python 3. User-Defined Data Structures in Python **Chapter 10: Data Structures (String)** 1. String 2. String Methods **Chapter 11: Data Structures (List)** 1. Lists 2. Built-In Functions Available in Lists 3. Two-Dimensional Lists **Chapter 12: Data Structures (Tuples, Sets, Dictionary)** 1. Data Structure 2. Tuples 3. Sets	It talks about Data Structure in Python.
Chapter 13: GUI Programming 1. What is Tkinter? 2. Widgets in Tkinter. 3. Button Event Handling 4. Canvas: Drawing on the Screen **Chapter 14: Python Database** 1. Introduction to Python Database 2. Python MySQL Database Installation 3. Implement Python MySQL Databases	It talks about GUI Programming and Database.
Chapter 15: Built-in-Functions 1. Built-In Function 2. Sort and Search 3. The Lambda Expression 4. Iterators and Generators 5. Modules **Chapter 16: NumPy** 1. NumPy	It talks about Data Science & Analysis.

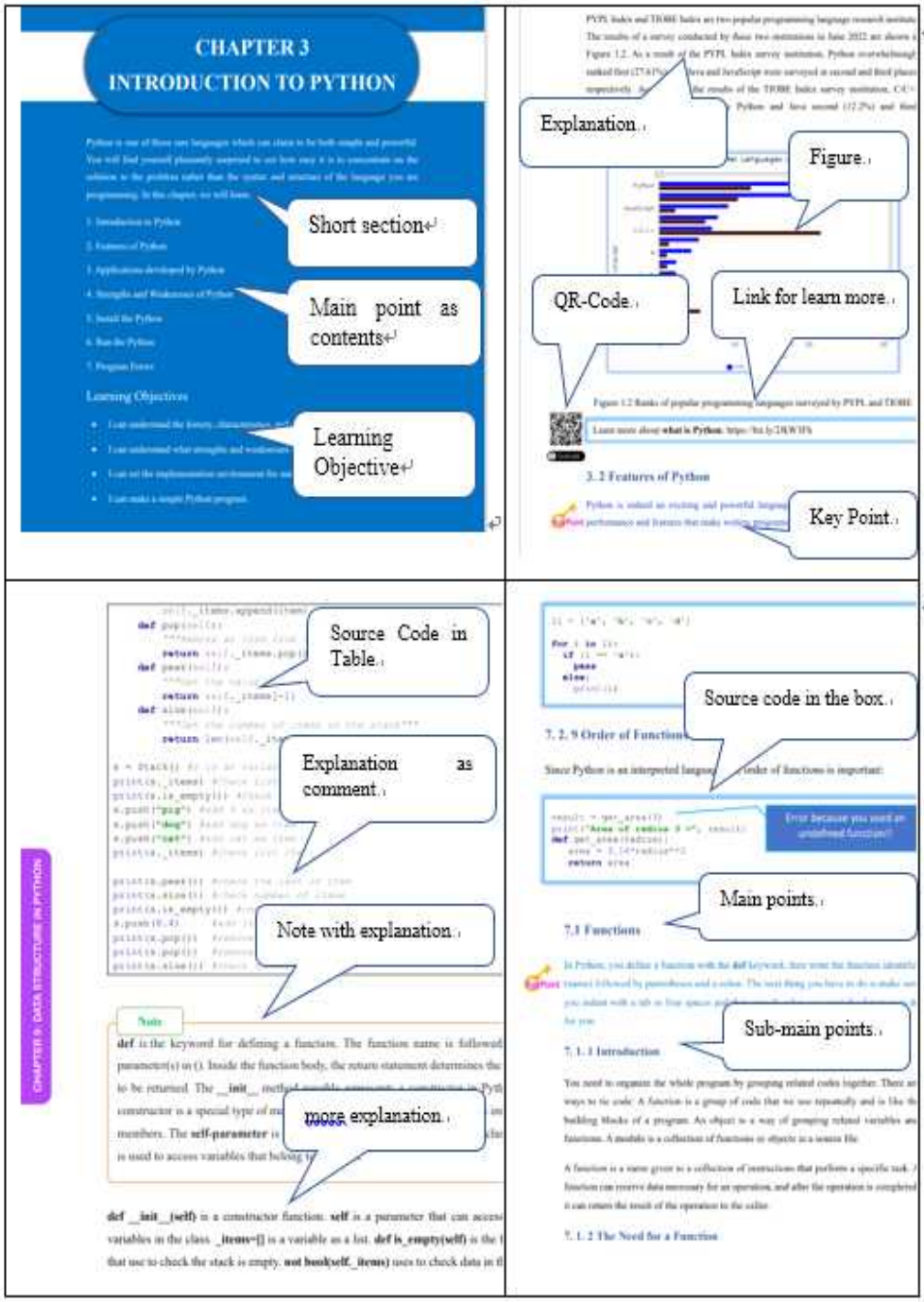
Contents	Main Points
2. Creating a NumPy Array 3. Inspecting a NumPy Array 4. NumPy Array Manipulation 5. NumPy Array Math Operators **Chapter 17: Pandas & Plotly** 1. NumPy-Data Science Cheat Sheet 2. What is Pandas? 3. Pandas Data Structure 4. Data Processing in Pandas 5. Plotly 6. Basic Charts 7. Charts for Plotly data analysis	

Ⅲ. Python Programming Textbook Development for ICT Pre-service Teacher

Python Programming Textbook provides the student with many technical and professional skills. They will get more experience in the first programming language. This book will provide students with the basics of the beginning of learning a Programming Language. For the first pages of each chapter, there is a short section that provides the concept with the points and objectives of the chapter.

In each part of each chapter, there are Key Points that are important to note or remember. The main point has some explanation paragraphs. Each sub-point has explanations in the box or table (coding) with a short comment. If that part is hard to understand or there needs to be more information, a note has been provided at that point with explanations.

All chapters have summaries, questions, and exercises for practice. To get a good result in teaching and learning this book, instructors can follow Syllabus, Lesson plan, PowerPoint lecture slides, and more resources provided by this book. Figure 1: sample of the Python Programming textbook shows the structure of this book.


CHAPTER 3
INTRODUCTION TO PYTHON
Short section
Main point as contents
Learning Objective
Explanation
Figure
QR-Code
Link for learn more
Key Point
Source Code in Table
Explanation as comment
Note with explanation
more explanation
Source code in the box
Main points
Sub-main points
CHAPTER 9: DATA STRUCTURE IN PYTHON

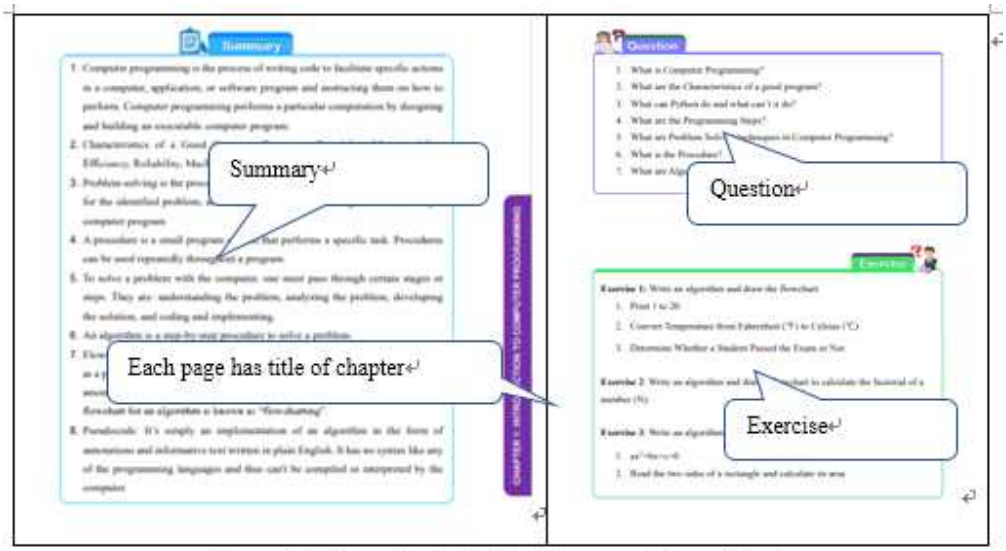


Figure 1: Example of a Python Programming textbook

IV. Flow of Teaching and Learning Python Programming

The flow of teaching and learning Python Programming there are two styles of teaching Python Programming. First, student practice during teaching. It means that teaching and learning practice at the same time. Students will follow a teacher one by one during lectures or practice. The second style is lecturing first and then the practice. Students will learn everything through the lecture as the teacher presents and then practice at different times.

V. Conclusions

Python Programming textbook will be provided to RTTC in Cambodia. The pre-service teacher will learn this book in the future. There are more material resources like Python Programming textbooks, teacher guides, lesson plans, slide lectures, and practice parts that will provide for them. The teacher will use the knowledge that they have learned with experiences to teach them. They will learn effectively and efficiently for use in their life.

References

[1]	Sweigart, A. (2019). Automate The Boring Stuff With Python. O'reilly Media.
[2]	Lutz, M. (2018). Learning Python. O'reilly.
[3]	Dr. Charles R. Severance (2009). Python for Everybody
[4]	Online: https://www.programiz.com/python-programming
[5]	Online: https://www.geeksforgeeks.org/python-programming-language/
[6]	Online: https://realpython.com/
[7]	Online: https://www.w3schools.com/python/

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Data Science and Computer Science Section in Informatics Education textbook for Pre-Service Teacher Education: In Case of Cambodia

Borath, Uk[1], and Hyun-Jong, Choe[2*]

[1]*Department of Computer Education, Korea National University of Education, Researcher, (uk.borath.hs@moeys.gov.kh)*

[2]*Department of Computer Education, Korea National University of Education, Professor, (chj@knue.ac.kr)*

ABSTRACT

The Informatics Education textbook was developed as part of the Project of ICT Capacity Building of Lower Secondary Education in Cambodia (2021-2026), supported by the Korea International Cooperation Agency with the cooperation of the Ministry of Education, Youth, and Sports (MoEYS) of Cambodia. Data Science and Computer Science in the Informatics education textbook discuss the fundamental concepts regarding teaching and learning data science. It highlights the fact that data science is emerging into a discipline, and it is significant to note that the essential component of data science is computer science and discuss data science pedagogy to enrich future computer science teachers' teaching methods.

정보교육 교과서는 교육청년체육부(MoEYS)와 한국국제협력단(KOICA)의 지원을 받아 캄보디아 중학교 ICT 역량강화 사업(2021~2026)의 일환으로 개발되었습니다. 캄보디아. 정보학 교육 교과서의 데이터 과학 및 컴퓨터 과학은 데이터 과학 교육 및 학습에 관한 기본 개념을 논의합니다. 데이터 과학이 하나의 학문으로 부상하고 있다는 사실을 강조하고, 데이터 과학의 필수 구성 요소가 컴퓨터 과학이라는 점에 주목하고 미래 컴퓨터 과학 교사의 교수법을 풍부하게 하기 위해 데이터 과학 교육학을 논의하는 것이 중요합니다.

K E Y W O R D S : Informatics Education, Data Science, Computer Science, Pre-Service Teacher Education

[2*]**Corresponding author:** ***Hyun-Jong Choe (chj@knue.ac.kr)***

Ⅰ. Introduction

Similar to other academic fields, computer science is constantly evolving. Although its fundamental principles are stable, its significance to society grows. Data science is an example of a field that exemplifies this concept.

In some ways, the two fields overlap with each other. While this chapter may be unfamiliar to students, it explains data science and its knowledge structure. A particular focus is placed on data science pedagogy from the perspectives of both the learners and the teachers.

Instructors can use data science to demonstrate to prospective computer science teachers how computers contribute to emerging new fields. It's an excellent way for prospective computer science teachers to learn more about this relatively new discipline, with which many of them may be unfamiliar [1].

In this study, the Data Science and Computer Science Section of the Informatics Education textbook has been developed as part of the Project for ICT Capacity Building of Lower Secondary Education in Cambodia development project financed by the Korea International Cooperation Agency supports ICT curriculum development projects to expand ICT capabilities, particularly for pre-service teachers in Cambodia.

Ⅱ. Core Concepts of Data Science and Computer Science

The contents and hours of the Data Science and Computer Science Section in the Informatics Education textbook for Regional Teacher Training Center are in the table 1. This section discusses data science as an example of a field that exemplifies this concept.

Tab.1 Data Science and Computer Science Section in Informatics Education Curriculum

Domain	Content	Hour	
Chapter 03 Data Science and Computer Science	3.1. Introduction 3.2. What Is Data Science? 3.3. The Structure of the Discipline of Data Science 3.4. Why Expose Computer Science Learners and Teachers to Data Science? 3.5. Preliminary Knowledge 3.6. Learning Environments for Data Science	4	4 5

Ⅲ. Data Science and Computer Science Textbook Development

The Informatics Education textbook is a guide for teaching computer science in lower secondary education. In addition to providing valuable knowledge for lower secondary school computer science teachers, this book is also beneficial for all computer science educators, such as high school computer science teachers, instructors of computer science teacher preparation programs, and university instructors of computer science. In every case, this book presents the rationale for addressing various topics in computer science education as well as detailed real-life teaching procedures (including activities, worksheets, discussion topics, etc.).

At the start of each chapter, we provide the objective in the most precise way possible. The chapters cover methods of teaching computer science, pedagogical skills, fundamental concepts of computer science, and other topics relevant to computer science education. These topics are presented in a manner that nurtures the knowledge of prospective computer science teachers regarding the subject matter, and their pedagogical content knowledge.

A Chapter Summary recaps the chapter's key concepts significant to the course. Correspondingly, the textbook includes a set of Questions and Exercises as a resource employed in the classroom. In other cases, it may be in the form of homework or assignments.

Thus, it fosters an environment where students can be independent learners and learn in a manner that encourages personal development. In doing so, students can identify their strengths and weaknesses, enhance their academic performance, become more motivated, develop problem-solving and critical thinking skills, and foster a

lifelong love of learning. Lastly, Additional Reading is a powerful tool that allows students to gain deeper insight through chapters from various sources, which serves as a more in-depth textbook reference than the book provides.

Data science emerges as the value of data increases for scientific research and industrial applications. A new science aims to discover and develop (a) financial and conceptual values and (b) new methods for converting massive data into insights. Data science can relate to almost all facets of our lives. It applies to industries, governments, NGOs, and the same holds for data science education. Data science is an interdisciplinary science that junctions three domains: computer science, mathematics, and statistics, as well as data domain knowledge.

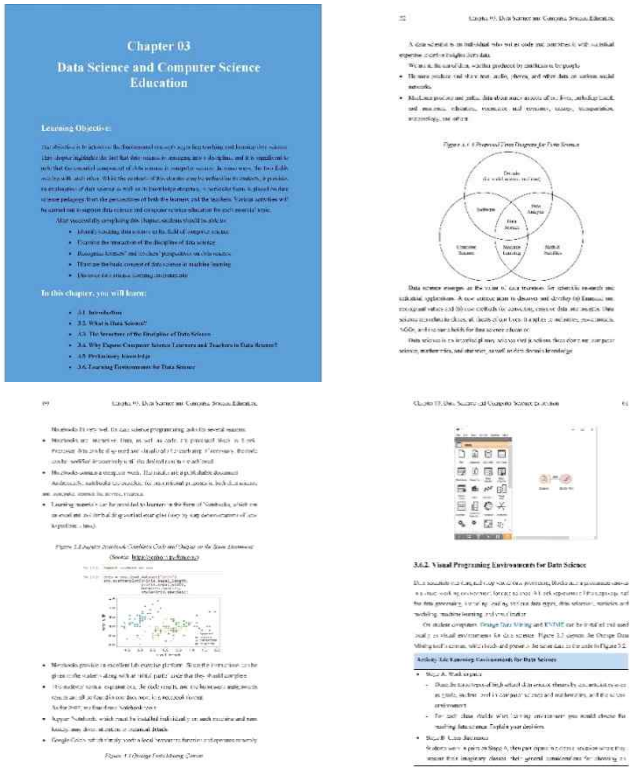


Fig. 1 Example of a textbook for Data Science and Computer Science Chapter

Ⅳ. The Flow of Teaching and Learning for Data Science and Computer Science

Students are introduced to data science in the field of computer science and how it has been used to apply information from data across various application fields by using scientific methods, procedures, algorithms, and systems to infer knowledge and insights from noisy, structured, and unstructured data. Data science domains are shown in a Venn diagram [2]. Students are guided through various topics about the structure of the discipline of data science and the reason for exposing computer science learners and teachers to data science and preliminary knowledge. Data science tools are used in the class, like Jupyter Notebook and Orange Data Mining [3-4]. Students are exposed to many activities throughout the class that let them experience and understand the concept more clearly.

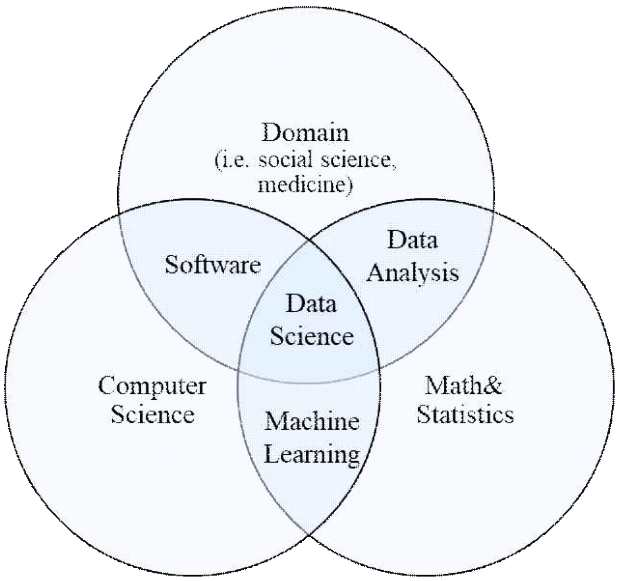


Fig. 2 A proposed Venn diagram for data science

```
In [1]: import seaborn as sns

In [2]: iris = sns.load_dataset("iris")
        sns.scatterplot(x=iris.sepal_length,
                        y=iris.sepal_width,
                        hue=iris.species,
                        style=iris.species);
```

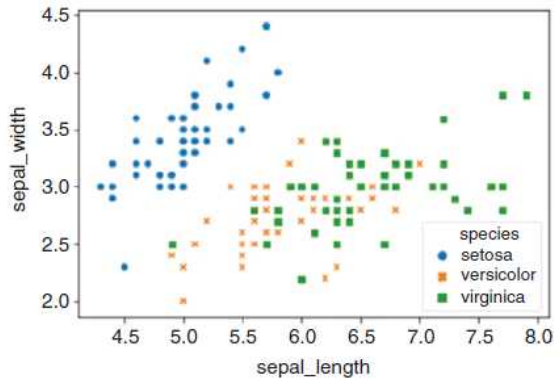


Fig. 3 Jupyter Notebook Combines Code and Output on the Same Document

Fig. 4 Orange Data Mining canvas

Ⅴ. Conclusions

This study follows a bottom-up progression of subjects where the fundamentals are introduced with more in-depth coverage, gradually building up to a very thorough presentation of knowledge. In this scenario, teachers and instructors are up to date with their knowledge of the content and pedagogy and can teach an entire course on these topics or just a few selected topics. With this textbook, each didactic aspect and principle can be applied when teaching these topics.

References

[1]	Lapidot, T., Hazzan, O., & Ragonis, N. (2020). Guide to Teaching Computer Science: An Activity-Based Approach. Springer International Publishing.
[2]	Conway D (2010) The data science venn diagram. Dataists. Retrieved from http://drewconway. com/zia/2013/3/26/the-data-science-venn-diagram
[3]	https://seaborn.pydata.org/
[4]	https://orange.biolab.si/

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Informatics Education Textbook for Pre-Service Teacher Education: In Case of Cambodia

Pisey, Pok[1], and Hyun-Jong, Choe[2*]

[1]Department of Computer Education, Korea National University of Education, Graduate Student, (pok.pisey.hs@moeys.gov.kh)
[2]Department of Computer Education, Korea National University of Education, Professor, (chj@knue.ac.kr)*

ABSTRACT

This study intends to introduce a new Informatics Education Textbook as part of the Korea International Cooperation Agency Project titled ICT Capacity Building of Lower Secondary Education in Cambodia. It was explicitly designed to address the needs of pre-service teachers who study at the Regional Teacher Training Center and to fill the ICT knowledge gap in the pre-service teachers' training program. It focuses on various ICT contents and pedagogy that nurtures prospective pre-service teachers' subject matter knowledge, pedagogical content knowledge, and pedagogical knowledge. Simply put, it has to do with how one teaches.

본 연구는 한국국제협력단의 캄보디아 중등교육 ICT역량강화 사업의 일환으로 새로운 정보교육교과서를 소개하고자 한다. 이는 지역 교사 연수 센터에서 공부하는 예비 교사의 요구를 해결하고 예비 교사 연수 프로그램의 ICT 지식 격차를 메우기 위해 명시적으로 설계되었습니다. 예비교사 예비교사의 교과지식, 교육내용지식, 교육학지식을 함양하는 다양한 ICT 콘텐츠 및 교수법에 중점을 두고 있다. 간단히 말해서, 가르치는 방법과 관련이 있습니다.

K E Y W O R D S : Informatics Education, Pre-Service Teacher, Teaching Methods, Pedagogy, Computer Science

[2*]**Corresponding author:** ***Hyun-Jong Choe*** *(chj@knue.ac.kr)*

I. Introduction

In recent years, Cambodia's Ministry of Education, Youth, and Sports (MoEYS) has been paying attention to the abundant job opportunities in the technology field. Therefore, students must take ICT classes to prepare for national and international job competitions. In 2017, Cambodia's MoEYS developed an ICT syllabus for lower secondary school education. As of now, this syllabus still needs to be implemented in schools [1]. As a matter of fact, ICT subjects will only be introduced once excellent teachers have been nurtured in ICT and textbooks have been developed. The Korea International Cooperation Agency (KOICA) was aware of this, which is why it established the KOICA-KNUE Global Education Leadership (ICT Education) Program to enhance Cambodian educators' knowledge and skills in ICT and develop textbooks that can be used in teaching pre-service teachers.

In this paper, the Informatics Education textbook has been developed as part of the KOICA's Project, intended to assist pre-service teachers in effectively teaching computer science in the future workplace, and places a special emphasis on the development of textbooks.

Ⅱ. Informatics Education's Curriculum

The Informatics Education textbook presents eleven chapters that follow a bottom-up progression of subjects. The fundamentals are introduced to a more in-depth coverage, gradually building up to a thorough of the entire textbook. The contents of curriculum and hours of the Informatics Education textbook are designed within 45 hours as Tab.1.

Tab.1 Informatics Education's Curriculum

Content	Hour	
Chapter 1: Overview of the Discipline of Computer Science 1. Introduction 2. How Significant is Computer Science in Today's World? 3. What is Computer Science? 4. The History of Computer Science 5. Computer Scientists 6. Social Issues of Computer Science Education 7. Programming Paradigms	4	45
Chapter 2: Computational Thinking 1. Introduction 2. The Concept of Computational Thinking 3. Computational Thinking in Computer Science Teachers Preparation 4. Activities for Developing Computer Science Teachers Preparation 5. Example of Simulations That Demonstrate Computational Thinking	4	
Chapter 3: Data Science and Computer Science Education 1. Introduction 2. What Is Data Science? 3. The Structure of the Discipline of Data Science 4. Why to Expose Computer Science Learners and Teachers to Data Science? 5. Preliminary Knowledge 6. Learning Environments for Data Science	4	
Chapter 4: Problem-Solving Strategies 1. Introduction 2. Problem-Solving Processes 3. Problem Understanding 4. Solution Design 5. Debugging 6. Reflection 7. Collaborative Problem-Solving	4	
Chapter 5: Learners' Alternative Conceptions 1. Introduction 2. Pedagogical Tools for Dealing with Alternative Conceptions 3. Activities About Strategies for Dealing with Alternative Conceptions	4	

Content	Hour	
Chapter 6: Teaching Methods in Computer Science Education 1. Introduction 2. Pedagogical Tools 3. Different Forms of Class Organization 4. Mentoring Software Project Development	4	
Chapter 7: STEM in Education 1. Introduction 2. Characteristics of STEM 3. A curriculum for STEM		
Chapter 8: Lab-Based Teaching 1. Introduction 2. What Is a Computer Lab? 3 The Lab-First Teaching Approach 4 Visualization and Animation 5 Using Online Resources in the Teaching of Computer Science	4	
Chapter 9: Assessment 1. Introduction 2. Different Types of Assessment 3. Tests 4. Project Assessment 5. Portfolio	4	
Chapter 10 Curriculum 1. Introduction 2. Etymology 3. Definitions and interpretations Professional interpretations 4. Types of curricula 5. Historical conception 6. Progressivist views 7. Cambodian ICT Curriculum in middle school		
Chapter 11: teaching Planning 1. Introduction 2.Top- Down Approach for Teaching Planning 3. Illustration: Teaching One-Dimensional Array	5	

Ⅲ. Textbook Development of Informatics Education

The Informatics Education textbook development follows a bottom-up progression of subjects where the fundamentals are introduced more in-depth. This "bottom-up" approach to Bloom's Taxonomy reflects the way many students learn a particular topic or concept. The first step is to learn new terminology, understand what that concept means, apply it in some specific situation, and subsequently evaluate and

analyze some scenarios, followed by creating something based on that concept [2].

It begins with an Overview of the Discipline of Computer Science, Computational Thinking, and Data Science and Computer Science Education (Chapters 1 to 3); Problem-Solving Strategies (Chapter 4); Learners' Alternative Conceptions (Chapter 5); Teaching Methods in Computer Science Education (Chapter 6); STEM in Education (Chapter 7); Lab-Based Teaching (Chapter 8); Assessment (Chapter 9); and it concludes with Curriculum and Teaching Planning (Chapter 10 and 11).

At the start of each chapter, the objective is provided in the most precise way possible. The chapters cover methods of teaching computer science, pedagogical skills, fundamental concepts of computer science, and other topics relevant to computer science education. These topics are presented in a manner that nurtures prospective computer science teachers' subject matter knowledge, pedagogical content knowledge, and pedagogical knowledge.

A **Chapter Summary** recaps the chapter's key concepts significant to the course. Correspondingly, the textbook equips a set of **Questions and Exercises** as a resource employed in the classroom. In other cases, it may be in the form of homework or assignments. Thus, it fosters an environment where students can be independent learners and learn in a manner that encourages personal development. In doing so, students can identify their strengths and weaknesses, enhance their academic performance, become more motivated, develop problem-solving and critical thinking skills, and foster a lifelong love of learning.

Lastly, **Additional Reading** is a powerful tool that allows students to gain deeper insight through chapters from various sources, which serves as a textbook reference.

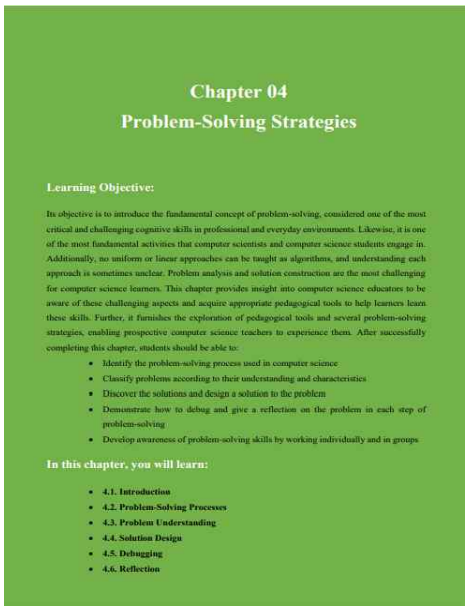
IV. The Flow of Teaching and Learning for Informatics Education

The Informatics Education textbook is designed for computer science teaching. In particular, it focuses on Methods of teaching computer science in which lower secondary computer science teachers acquire pedagogical training. All of its ideas can easily be adapted to teaching any computer science topic, from elementary to university.

Various teaching methods are incorporated into this textbook and are essential for understanding the course. Instead of just discussing teaching principles, it actively illustrates how to apply them in the teaching of computer science. This includes

lectures, workshops for creating teaching materials and skills, hands-on experience with various computational tools and programming environments, teaching exercises and practicing, many discussions and reflections. As a result of the learning process, course tasks and assignments differ. A variety of tasks are available, including preparing learning activities and lesson plans, analyzing learners' mistakes, reading articles, writing reports, analyzing how to manage classes, how to use the computer lab specifically, preparing teaching plans for entire teaching units, and exploring the uniqueness of computer science as a discipline. These activities cover different (pedagogical) computer science topics in the textbook. In addition, the course promotes cooperative learning. Presenting students' work to their peers and receiving feedback from them and the instructor allows students to learn from one another. Written and oral feedback is both possible. Students who develop products during the course can share them with one another for future use in the class or for schoolwork [3].

Fig. 1 Example of a textbook for Informatics Education



Chapter 04
Problem-Solving Strategies

Learning Objective:

Its objective is to introduce the fundamental concept of problem-solving, considered one of the most critical and challenging cognitive skills in professional and everyday environments. Likewise, it is one of the most fundamental activities that computer scientists and computer science students engage in. Additionally, no uniform or linear approaches can be taught as algorithms, and understanding each approach is sometimes unclear. Problem analysis and solution construction are the most challenging for computer science learners. This chapter provides insight into computer science educators to be aware of these challenging aspects and acquire appropriate pedagogical tools to help learners learn these skills. Further, it furnishes the exploration of pedagogical tools and several problem-solving strategies, enabling prospective computer science teachers to experience them. After successfully completing this chapter, students should be able to:

- Identify the problem-solving process used in computer science
- Classify problems according to their understanding and characteristics
- Discover the solutions and design a solution to the problem
- Demonstrate how to debug and give a reflection on the problem in each step of problem-solving
- Develop awareness of problem-solving skills by working individually and in groups

In this chapter, you will learn:

- 4.1. Introduction
- 4.2. Problem-Solving Processes
- 4.3. Problem Understanding
- 4.4. Solution Design
- 4.5. Debugging
- 4.6. Reflection

Chapter 04: Problem-Solving Strategies 71

4.1. Introduction

Students must use and integrate various ideas and competencies when programming because it is a problem-solving process. Schools and other academic institutions frequently provide instruction on the importance of problem-solving skills in computer science. Learning programming languages in schools is typically well organized within a curriculum, but learning problem-solving skills is less structured and more implicit.

The problem-solving process involves complex mental processes. This observation can be seen, for instance, by considering the problem-solving techniques listed on Wikipedia: abstraction, analogy, brainstorming, divide and conquer, hypothesis testing, lateral thinking, means-ends analysis, method of objects, morphological analysis, reduction, research, root cause analysis, and trial and error.

Many disciplines share common methods for solving problems. For instance, there is a lot of discussion about problem-solving methods and strategies, as well as how to teach problem-solving techniques to students and their challenges.

Sometimes students create their own methods for solving problems. For instance, children develop basic addition and subtraction skills even before they start learning arithmetic in school. However, even the most creative student may employ unproductive trial-and-error problem-solving procedures without formal instruction on effective strategies. Therefore, it is crucial to instruct teachers on how to teach their students problem-solving techniques.

Computer science Educators are responsible for understanding problem-solving strategies and developing pedagogical tools to help students acquire these skills. As a means of addressing and mediating them, the chapter presents several agreed-upon problem-solving strategies. It also offers several new perspectives on computer science problem-solving.

4.2. Problem-Solving Processes

A fundamental problem-solving process begins with outlining the problem's requirements and ends with outlining a solution, sometimes expressed by a series of steps. In many cases, an algorithm in computer science is written in a programming language and tested through code execution. The challenging stages are in between: how

V. Conclusions

Many aids are required to make the teaching and learning of ICT education easier. As one of these aids, a textbook is one of the most significant [4]. The Informatics

Education textbook is important as it contributes to filling the gap of the yet-to-be-implemented syllabus of MoEYS. As a result of these teaching and learning guidelines, the teacher clearly understands what is expected when teaching specific topics. Also, they know the best way to assist students in learning and assimilation. Through the Informatics Education textbook, pre-service students will have the chance to accumulate a great deal of knowledge.

References

[1]	Ministry of Education, Youth, and Sports. (2018). Detailed Syllabus for ICT at the Lower Secondary Level. Phnom Penh: Ministry of Education, Youth and Sports, Cambodia.
[2]	Online: Bloom's Taxonomy: Bottom-Up or Top-Down? https://resilienteducator.com/instructional-design/blooms-taxonomy-bottom-up-or-top-down/
[2]	Hazzan, O., Ragonis, N., & Lapidot, T. (2020). Guide to Teaching Computer Science: An Activity-Based Approach. Springer International Publishing.
[4]	Online: Why Textbooks are Important https://rasmedpublications.com/why-textbooks-are-important/#:~:text=Textbooks%20serve%20as%20a%20guide, guidelines%20for%20teaching%20and%20learning.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Assessment Section in Informatics Education textbook for ICT Pre-service Teacher: In Case of Cambodia

Puthy Ty[1], and Hyunjong Choe[2*]
[1]Kandal Regional Teacher Training Center, Ministry of Education Youth and Sport, ICT Teacher Educator, (ty.puthy.rttc@moeys.gov.kh)

[2]Department of Computer Education, Korea National University of Education, Professor, (chj@knue.ac.kr)

ABSTRACT

This study intends to build the Assessment section in the Informatics Education textbook as part of the Project for ICT Capacity Building of Lower Secondary Education in Cambodia development project financed by the Korea International Cooperation Agency with the cooperation of the Ministry of Education, Youth and Sports (MoEYS) of Cambodia. One of the most common tasks performed in the early stages of a teacher's professional development action plan is assessment. Therefore, these tasks should be covered and taught to pre-service students to emphasize the distinctiveness of the assessments on lower secondary school students' knowledge in the case of ICT courses. Through the textbook with curated learning materials, pre-service teachers and in-service teachers will be able to develop assessment tools for evaluating their lower secondary school student's knowledge and encourage them to learn efficiently and effectively.

본 연구는 교육청년체육부의 협력으로 한국국제협력단이 지원하는 캄보디아 중등교육 ICT 역량 강화 사업의 일환으로 정보교육 교과서에 평가 항목을 신설하고자 한다. MoEYS) 캄보디아. 교사의 전문성 개발 실행 계획의 초기 단계에서 수행되는 가장 일반적인 작업 중 하나는 평가입니다. 따라서 ICT 과정의 경우 중학교 학생들의 지식에 대한 평가의 차별성을 강조하기 위해 이러한 과제를 예비 학생들에게 가르치고 다루어야 합니다. 선별된 학습 자료가 포함된 교과서를 통해 예비 교사와 현직 교사는 중학교 학생들의 지식을 평가하기 위한 평가 도구를 개발하고 효율적이고 효과적으로 학습하도록 장려할 수 있습니다.

K E Y W O R D S : ICT Assessment, Test Construction, Question Type for Computer Science, Assessment Type, Standard Test

[2*]**Corresponding author:** ***Hyunjong Choe (chj@knue.ac.kr)***

Ⅰ. Introduction

One of the most common tasks performed in the early stages of a teacher's professional development action plan is assessment. Therefore, these tasks should be covered and taught to pre-service students in a way that emphasizes the distinctiveness of the assessments on lower secondary school students' knowledge in the case of ICT courses. The objectives assessment is done to help students learn better. It can involve a variety of ungraded indicators of student comprehension and be applied to improve pedagogical approaches. The learner should be involved in a reflective process during the assessment that increases self-awareness of one's learning processes. The assessment should be fair and pertinent to the desired learning results. A variety of assessment tools should be employed in accordance with the greater awareness of learner diversity to allow each learner to exploit all his or her learning potential fully. Furthermore, assessment is improved pedagogical approaches means that first, teachers improve their understanding of the current knowledge of their learners, and second, learners get feedback related to their own understanding of the learned topic [1].

By creating and disseminating online educational materials and spreading digital education infrastructure like e-learning systems through projects to improve ICT education capabilities in Cambodian lower secondary schools, Korea helps to provide high-quality education and close the digital education gap [2].

This study intends to build the Assessment section as part of the Project for ICT Capacity Building of Lower Secondary Education in Cambodia development project financed by the Korea International Cooperation Agency supports ICT curriculum development projects to expand ICT capabilities, particularly for pre-service teachers in Cambodia.

Ⅱ. Assessment Section of Informatics Education Textbook Development

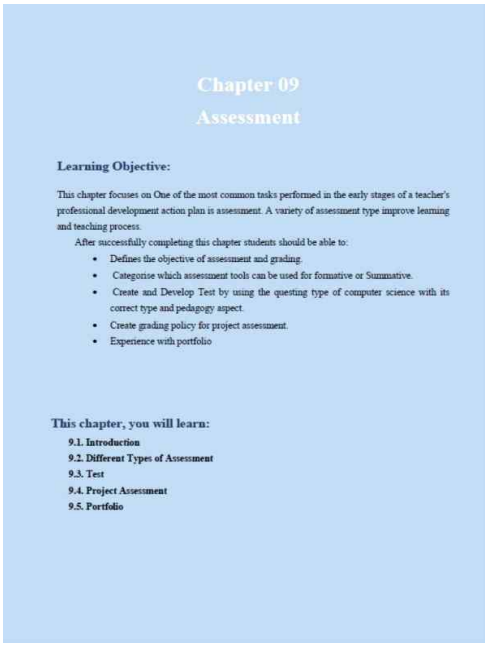
The hours of the Assessment section are assigned 4 hours of 45 hours in Informatics Education Subject for the first years of each major (ICT-ENG and ENG-ICT) in the teacher training curriculum. The contents of assessment are in table 1.

Tab.1 Assessment Section of Informatics Education in RTTC Curriculum

Domain	Content	Hour	
Informatics Education	**Chapter 9: Assessment** 9.1. Introduction 9.2. Different Types of Assessment 9.2.1. Formative and Summative Assessment 9.2.2. Self- and Peer-Assessment 9.2.3 Automated Assessment 9.3. Test 9.3.1. Test Construction and Assessment 9.3.2. Reference Materials to Be Used in Exam 9.4. Project Assessment 9.4.1. Individual Projects 9.4.2. Team Projects 9.5. Portfolio	4	45

The Part of the Assessment section is as follows. First, the **Cover Page** guides the section's title, introduction, learning objective, and content. Second, The **Introduction** opens the discussion with representative problems consisting of motivation and key terms to give the reader an overview of what to expect from the chapter. Third, **Activities** are the practice part that focuses on learning activities to understand each content such as subject matter knowledge, pedagogical content knowledge, and pedagogical knowledge. Fourth, **A Chapter Summary** recaps the chapter's key concepts significant to the course. Fifth, the chapter equips a set of **Questions** and **Exercises** as a resource employed in the classroom. In other cases, it may be in the form of homework or assignments. Thus, it fosters an environment where students can be independent learners and learn in a manner that encourages personal development. In doing so, students can identify their strengths and weaknesses, enhance their academic performance, become more motivated, develop problem-solving and critical thinking skills, and foster a lifelong love of learning. Lastly, **Additional Reading** allows students to gain deeper insight through chapters from various sources, which serves as a chapter or textbook reference more in-depth than the chapter provides.

Fig. 1 Example of the parts for Assessment Section



Chapter 09
Assessment

Learning Objective:

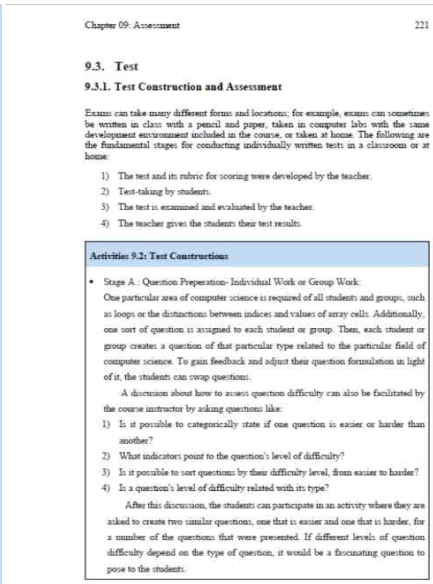
This chapter focuses on One of the most common tasks performed in the early stages of a teacher's professional development action plan is assessment. A variety of assessment type improve learning and teaching process.

After successfully completing this chapter students should be able to:

- Defines the objective of assessment and grading.
- Categorise which assessment tools can be used for formative or Summative.
- Create and Develop Test by using the questing type of computer science with its correct type and pedagogy aspect.
- Create grading policy for project assessment.
- Experience with portfolio

This chapter, you will learn:

9.1. Introduction
9.2. Different Types of Assessment
9.3. Test
9.4. Project Assessment
9.5. Portfolio



9.3. Test

9.3.1. Test Construction and Assessment

Exams can take many different forms and locations; for example, exams can sometimes be written in class with a pencil and paper, taken in computer labs with the same development environment included in the course, or taken at home. The following are the fundamental stages for conducting individually written tests in a classroom or at home:

1) The test and its rubric for scoring were developed by the teacher.
2) Test-taking by students.
3) The test is examined and evaluated by the teacher.
4) The teacher gives the students their test results.

Activities 9.2: Test Constructions

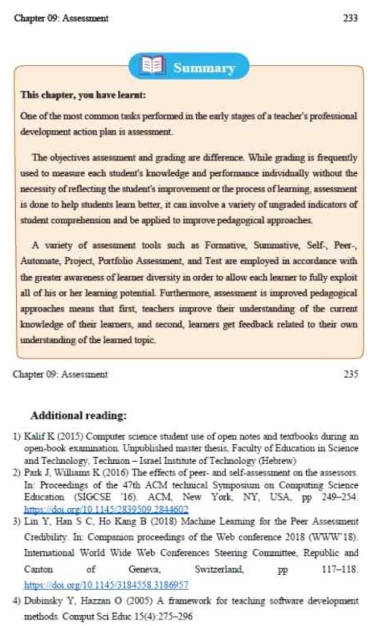
- Stage A : Question Preperation- Individual Work or Group Work:

One particular area of computer science is required of all students and groups, such as loops or the distinctions between indices and values of array cells. Additionally, one sort of question is assigned to each student or group. Then, each student or group creates a question of that particular type related to the particular field of computer science. To gain feedback and adjust their question formulation in light of it, the students can swap questions.

A discussion about how to assess question difficulty can also be facilitated by the course instructor by asking questions like:

1) Is it possible to categorically state if one question is easier or harder than another?
2) What indicators point to the question's level of difficulty?
3) Is it possible to sort questions by their difficulty level, from easier to harder?
4) Is a question's level of difficulty related with its type?

After this discussion, the students can participate in an activity where they are asked to create two similar questions, one that is easier and one that is harder, for a number of the questions that were presented. If different levels of question difficulty depend on the type of question, it would be a fascinating question to pose to the students.



Summary

This chapter, you have learnt:

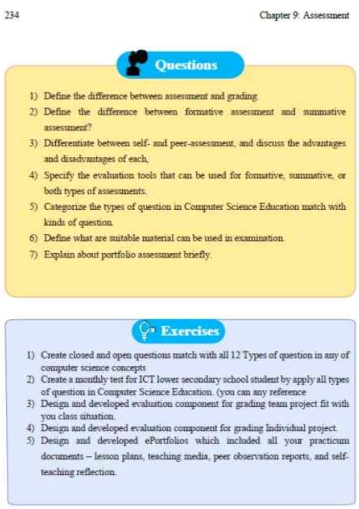
One of the most common tasks performed in the early stages of a teacher's professional development action plan is assessment.

The objectives assessment and grading are difference. While grading is frequently used to measure each student's knowledge and performance individually without the necessity of reflecting the student's improvement or the process of learning, assessment is done to help students learn better, it can involve a variety of ungraded indicators of student comprehension and be applied to improve pedagogical approaches.

A variety of assessment tools such as Formative, Summative, Self-, Peer-, Automate, Project, Portfolio Assessment, and Test are employed in accordance with the greater awareness of learner diversity in order to allow each learner to fully exploit all of his or her learning potential. Furthermore, assessment is improved pedagogical approaches means that first, teachers improve their understanding of the current knowledge of their learners, and second, learners get feedback related to their own understanding of the learned topic.

Additional reading:

1) Kalif K (2015) Computer science student use of open notes and textbooks during an open-book examination. Unpublished master thesis, Faculty of Education in Science and Technology, Technion – Israel Institute of Technology (Hebrew)
2) Park J, Williams K (2016) The effects of peer- and self-assessment on the assessors. In: Proceedings of the 47th ACM technical Symposium on Computing Science Education (SIGCSE '16). ACM, New York, NY, USA, pp 249–254. https://doi.org/10.1145/2839509.2844602
3) Lin Y, Han S C, Ho Kang B (2018) Machine Learning for the Peer Assessment Credibility. In: Companion proceedings of the Web conference 2018 (WWW'18). International World Wide Web Conferences Steering Committee, Republic and Canton of Geneva, Switzerland, pp 117–118. https://doi.org/10.1145/3184558.3186957
4) Dubinsky Y, Hazzan O (2005) A framework for teaching software development methods. Comput Sci Educ 15(4):275–296



Questions

1) Define the difference between assessment and grading.
2) Define the difference between formative assessment and summative assessment?
3) Differentiate between self- and peer-assessment, and discuss the advantages and disadvantages of each.
4) Specify the evaluation tools that can be used for formative, summative, or both types of assessments.
5) Categorize the types of question in Computer Science Education match with kinds of question.
6) Define what are suitable material can be used in examination.
7) Explain about portfolio assessment briefly.

Exercises

1) Create closed and open questions match with all 12 Types of question in any of computer science concepts
2) Create a monthly test for ICT lower secondary school student by apply all types of question in Computer Science Education. (you can any reference
3) Design and developed evaluation component for grading team project fit with you class situation.
4) Design and developed evaluation component for grading Individual project.
5) Design and developed ePortfolios which included all your practicum documents – lesson plans, teaching media, peer observation reports, and self-teaching reflection.

Ⅲ. The Flow of Teaching and Learning for Assessment Section

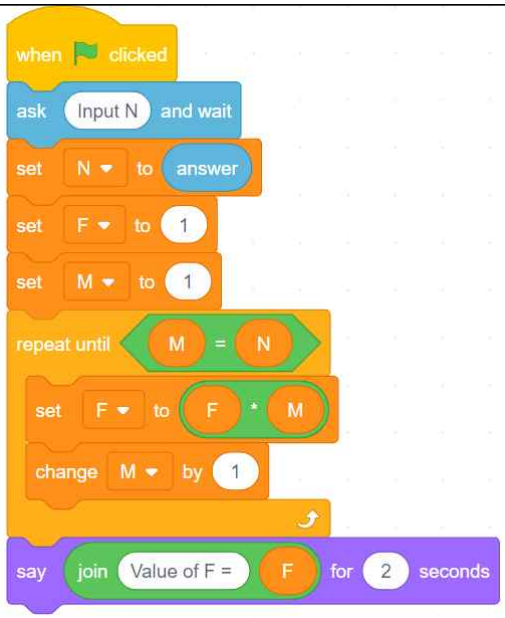
The flow of teaching and learning is as follows. First, pre-service students are introduced to the overview and objective of the section. For example, (in section **9.3.1. Test Construction and Assessment)** Exams can sometimes be written in class with a pencil and paper, taken in computer labs with the same development environment included in the course, or taken at home. The following are the fundamental stages for conducting individually written tests in a classroom or at home:

1) The teacher developed the test and its rubric for scoring.
2) Test-taking by students.
3) The test is examined and evaluated by the teacher.
4) The teacher gives the students their test results

Second, they are asked to work on activities in this section as a team or individually. Stage A: Question Preparation - Individual Work or Group Work: One area of computer science is required of all students and groups, such as iterations. Then, each student or group creates a question of that type related to that field of computer science. (See **Activities 9.2)**

Tab.2 Question Preparation

Question Code:	Com7_1	**Source**
Subject:	Computer Science	☐Textbook
Grade:	7	☐Teacher Guide
Sub-area:	Iteration	☐Author
Objective:	Student can find correct answer by analysis of the code execution	☐Standard Syllabus
Cognitive Domain:	Analysist	**Difficulty Level**
Question Kind:	Closed Question	☐Easy
Question Type:	Type 4-Analysis of Code Execution	☐Medium
Duration:	5 minutes	☐Hard
Score:		
Q: Choose the correct answer of value of F in the program below when user input value of N equal to 5**.**		

☐A. Value of F = 1 ☐ B. Value of F = 24 ☐ C. Value of F = 100 ☐ D. Value of F = 120 ☐ E. None of Above	
The correction Answer: ☑ B. Value of F =24	
Answer Analysis:	
Author name:	

A discussion about how to assess question difficulty can also be facilitated by the course instructor by asking questions like:

- Is it possible to categorically state if one question is easier or harder than another?
- What indicators point to the question's level of difficulty?
- Is it possible to sort questions by their difficulty level, from easier to harder?
- Is a question's level of difficulty related with its type?

Then continue to the next Stage unit end of stage in these activities.

As instructors, we can use PowerPoint presentation lecture slides, lesson plans, and worksheets as teaching materials to teach match with Syllabus.

IV. Conclusions

Cambodia's pre-service teacher textbook, which will be developed and used in the teacher education curriculum, needs to distribute curated learning materials that reconstruct and provide various information existing on the web, such as videos, images, articles, documents, diagrams, games, activities and practice questions, to suit the lecture theme. Through the textbook with curated learning materials, pre-service and in-service teachers can develop assessment tools for evaluating their lower secondary school student's knowledge and encourage them to learn efficiently and effectively.

References

[1]	Hazzan, O., Ragonis, N., & Lapidot, T. (2020). Guide to Teaching Computer Science: An Activity-Based Approach. Springer International Publishing.
[2]	Norman, D.(2004). Emotional Design: Why We Love (or Hate) Everyday Things. New York: Basic Books.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Teaching Methods Section in Informatics Education textbook for Pre-service Teacher Education: In Case of Cambodia

Mengheng Samang *[1] , and Hyeon-jong Choe [2*]
[1]Department of Computer Education, Korea National University of Education, Graduate Student, (samang.mengheng.hs@moeys.gov.kh)

[2]Department of Computer Education, Korea National University of Education, Professor, (chj@knue.ac.kr)

ABSTRACT

This study intends to provide computer science instructors with active-learning-based teaching methods they can use in the classroom. This section aims to introduce students to various teaching methods before they begin their careers as computer science teachers, discuss the advantages and disadvantages of those methods, and demonstrate situations in high school teaching where using those methods is appropriate. This section covers three topics: pedagogical tools (games, CS-Unplugged, rich tasks, concept maps, classification, and metaphors); various methods of class organization; and mentoring software project development. After completing this section, students should be able to use pedagogical tools that computer science educators can employ in the classroom efficiently and effectively.

본 연구는 컴퓨터 공학 강사들이 교실에서 활용할 수 있는 능동적 학습 기반 교수법을 제공하고자 한다. 이 섹션은 학생들이 컴퓨터 과학 교사로 경력을 시작하기 전에 다양한 교육 방법을 소개하고, 이러한 방법의 장단점을 논의하고, 고등학교 교육에서 이러한 방법을 사용하는 것이 적절한 상황을 보여 주는 것을 목표로 합니다. 이 섹션에서는 세 가지 주제를 다룹니다. 교육 도구(게임, CS-Unplugged, 풍부한 작업, 개념 맵, 분류 및 은유); 다양한 학급 조직 방법; 소프트웨어 프로젝트 개발 멘토링. 이 섹션을 완료한 후 학생들은 컴퓨터 과학 교육자가 교실에서 효율적이고 효과적으로 사용할 수 있는 교육 도구를 사용할 수 있어야 합니다.

K E Y W O R D S : Active-learning-based, Teaching methods, CS-Unplugged, Rich tasks, Concept maps, Classification, Metaphors

[2*]**Corresponding author:** ***Hyeon-jong Choi (chj@knue.ac.kr)***

Ⅰ. Introduction

Using suitable teaching and learning methods in ICT education is becoming more important. By providing ICT teachers with active-learning-based teaching methods, they can use them in the classroom. This study aims to introduce students to various teaching methods before they begin their careers as ICT teachers, discuss the advantages and disadvantages of those methods, and demonstrate situations in high school teaching where using those methods is appropriate. Since most activities concentrate on a particular computer science topic, they also provide prospective ICT teachers another chance to deepen their understanding of computer science concepts. By describing each teaching method's purpose, target, and importance for computer science education, ICT teachers are offered activities based on active learning. The actual facilitation of these activities is crucial because it allows the students to experience what their future high school students will feel when they use these teaching methods in their classes as ICT teachers.

Ⅱ. Pedagogical Tools

There are some pedagogical tools for ICT teaching and learning methods.

Pedagogical game is the first tool for ICT. Games have a lot of pedagogical potentials. A well-planned game enables students to learn new concepts in an alternative class atmosphere, involves social interaction, introduces a change in the teaching method, and is a kind of activity that all students are good at. Games, like other pedagogical tools, can have disadvantages. For example, a game might be perceived as causing chaos in the classroom. Or, a game might be overtaken by a student with ability.

The CS-Unplugged approach is learning activity that teaches computer science through engaging activities and puzzles using cards, crayons, and active playing. The activities introduce students to computational thinking through concepts such as binary numbers, sorting algorithms, data structures, and data compression without connecting them directly to computers or programming.

Rich tasks are programming exercises that (a) can be solved in a variety of ways, when each solution elicits and promotes a discussion about one or more central computer science ideas, and (b) can be solved within the duration of one lesson

based on learners' current knowledge; thus, both the solution process and the discussion about its variety of solutions take place in the same lesson (Lapidot and Levy 1993; Levy and Lapidot 1997).

Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line referred to as linking words or phrases specify the relationship between the two concepts. (Novak and Cañas (2008))

Classification specifically as a teaching method in Informatics education. To aid and direct learners' conceptualization of computer science concepts, we put a lot of emphasis on classifying objects and phenomena from real life.

Metaphors are used to understand and experience one specific thing by analogy to another, which is usually a familiar concept (Lakoff and Johnson 1980). Consider some of the metaphors frequently used in computer science: pointers, a menu, windows, a mouse, a tree, and computer memory. As a result, and given that the use of metaphors is also an effective pedagogical tool, teachers of computer science should be familiar with the typical metaphors used in the field, understand their significance as well as their limitations, and learn how to use them in learning and teaching processes effectively.

Ⅲ. Teaching Methods Section in Informatics Education Textbook Development

The purpose of this section is as follows.

First, to let the students experience (as learners and as teachers) various teaching methods before becoming ICT teachers. Second, to discuss the advantages and disadvantages of these teaching methods; third, to demonstrate high school teaching situations in which it is appropriate to employ them. Third, to vary the teaching methods employed in the classroom. Since, in most cases, the activities carried out in the classroom focus on a specific computer science topic, they also provide prospective ICT teachers additional opportunities to improve their understanding of computer science concepts.

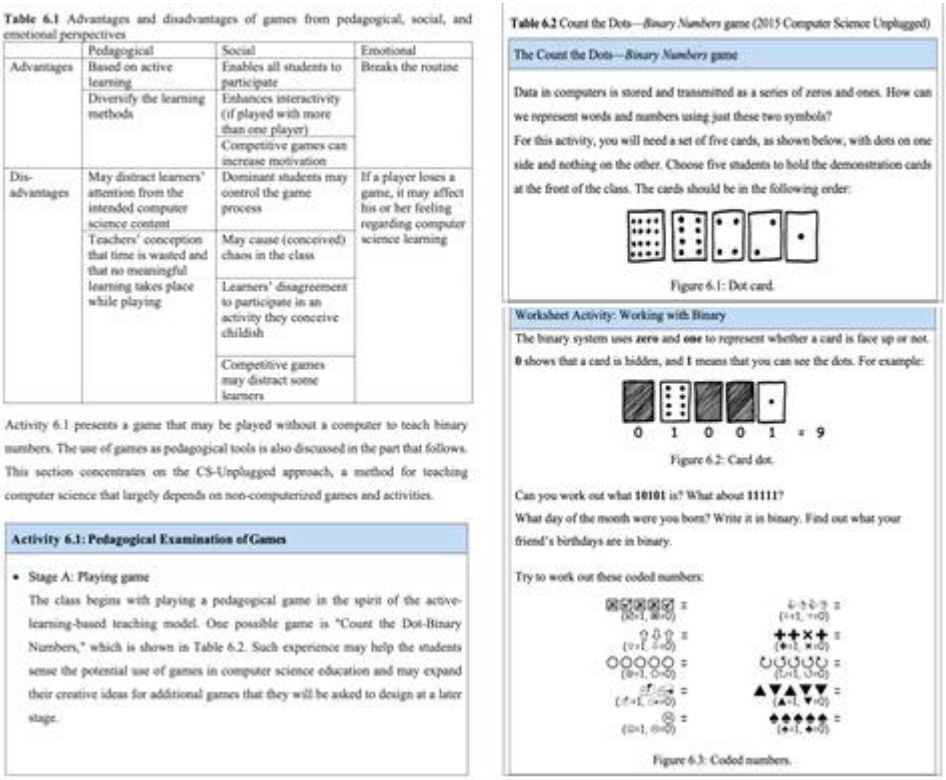


Table 6.1 Advantages and disadvantages of games from pedagogical, social, and emotional perspectives

	Pedagogical	Social	Emotional
Advantages	Based on active learning	Enables all students to participate	Breaks the routine
	Diversify the learning methods	Enhances interactivity (if played with more than one player)	
		Competitive games can increase motivation	
Dis-advantages	May distract learners' attention from the intended computer science content	Dominant students may control the game process	If a player loses a game, it may affect his or her feeling regarding computer science learning
	Teachers' conception that time is wasted and that no meaningful learning takes place while playing	May cause (conceived) chaos in the class	
		Learners' disagreement to participate in an activity they conceive childish	
		Competitive games may distract some learners	

Activity 6.1 presents a game that may be played without a computer to teach binary numbers. The use of games as pedagogical tools is also discussed in the part that follows. This section concentrates on the CS-Unplugged approach, a method for teaching computer science that largely depends on non-computerized games and activities.

Activity 6.1: Pedagogical Examination of Games

- Stage A: Playing game

  The class begins with playing a pedagogical game in the spirit of the active-learning-based teaching model. One possible game is "Count the Dot-Binary Numbers," which is shown in Table 6.2. Such experience may help the students sense the potential use of games in computer science education and may expand their creative ideas for additional games that they will be asked to design at a later stage.

Table 6.2 Count the Dots—*Binary Numbers* game (2015 Computer Science Unplugged)

The Count the Dots—*Binary Numbers* game

Data in computers is stored and transmitted as a series of zeros and ones. How can we represent words and numbers using just these two symbols?

For this activity, you will need a set of five cards, as shown below, with dots on one side and nothing on the other. Choose five students to hold the demonstration cards at the front of the class. The cards should be in the following order:

Figure 6.1: Dot card.

Worksheet Activity: Working with Binary

The binary system uses **zero** and **one** to represent whether a card is face up or not. **0** shows that a card is hidden, and **1** means that you can see the dots. For example:

0 1 0 0 1 = 9

Figure 6.2: Card dot.

Can you work out what **10101** is? What about **11111**?

What day of the month were you born? Write *it* in binary. Find out what your friend's birthdays are in binary.

Try to work out these coded numbers:

Figure 6.3: Coded numbers.

Fig. 1 Example of Teaching Methods Section in Informatics Education Textbook

Ⅳ. The Flow of Teaching and Learning for Teaching Methods Section in Informatics Education

The flow of teaching and learning is as follows. First, students learn the concept of the teaching methods and learn about a class organization taken from the constructivist approach. There are better ways to improve learning processes and how to conduct and use each pedagogical tool in Informatics education. Second, students practice using the activity of the pedagogical tools to apply in the classroom.

Ⅴ. Conclusions

Cambodia's lower secondary education ICT textbooks will be developed and used in the future. In addition to providing valuable knowledge for lower secondary school ICT teachers, this book is again beneficial for all ICT educators, such as high school ICT teachers, instructors of ICT teacher preparation programs, and university instructors of computer science. In every case, this book presents the rationale for addressing various topics in Informatics education and detailed real-life teaching procedures (including activities, worksheets, discussion topics, and more). Through this, students can learn efficiently and effectively online and offline.

References

[1]	Celepkolu M, Boyer KE (2018a) Thematic analysis of students' reflections on pair programming in CS1. In: SIGCSE '18 proceedings of the 49th ACM technical symposium on computer science education, Baltimore, Maryland, USA, pp 771–776. https://doi.org/10.1145/3159450.3159516
[2]	Celepkolu M, Boyer KE (2018b) The importance of producing shared code through pair programming. In: SIGCSE '18 proceedings of the 49th ACM technical symposium on computer science education, Baltimore, Maryland, USA, pp 765–770. https://doi.org/10.1145/3159450.3159506
[3]	Computer science without a computer. CS Unplugged. (n.d.). Retrieved November 21, 2022, from https://www.csunplugged.org/en/
[4]	Hazzan, O., Ragonis, N., & Lapidot, T. (2020). Chapter 10 Teaching Methods in Computer Science Education. In Guide to teaching computer science: An activity- based approach (pp. 181–218). essay, Springer International Publishing.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Introduction to Computer for ICT Pre-Service Teacher: In Case of Cambodia

Panharith, Hout[1], and Seung Hyun, Kim[2*]
[1]Ministry of Education Youth and Sport, Cambodia, ICT High School Teacher (huot.panharith.hs@moeys.gov.kh)

[2]Department of Computer Education, Korea National University of Education, Professor, (kimsh@knue.ac.kr)

ABSTRACT

This study intends to build the Introduction to Computer Textbook as part of the Project of ICT Capacity Building of Lower Secondary Education in Cambodia, supported by the Korea International Cooperation Agency. As for computer science students, most begin their studies with the illusion that computer science is programming, web browsing, and Internet file sharing because that is essentially all they have seen. Beginning computer science students need exposure to the breadth of the subject, they plan to major in. Providing this exposure is the theme of this book. It gives students an overview of computer science – a foundation from which they can appreciate the relevance and interrelationships of future courses in the field. Students can learn efficiently and effectively online and offline through the textbook with curated learning materials.

본 연구는 한국국제협력단이 지원하는 캄보디아 중학교 ICT 역량강화 사업의 일환으로 컴퓨터교과서 개론을 구축하고자 한다. 컴퓨터 과학 학생들의 경우, 대부분은 컴퓨터 과학이 프로그래밍, 웹 브라우징, 인터넷 파일 공유라는 환상을 가지고 공부를 시작합니다. 컴퓨터 과학을 시작하는 학생은 해당 주제의 폭을 접할 필요가 있으며 전공할 계획입니다. 이러한 노출을 제공하는 것이 이 책의 주제입니다. 이 과정은 학생들에게 컴퓨터 과학에 대한 개요를 제공합니다. 즉, 해당 분야에서 향후 과정의 관련성과 상호 관계를 이해할 수 있는 토대입니다. 학생들은 선별된 학습 자료가 포함된 교과서를 통해 온라인과 오프라인에서 효율적이고 효과적으로 학습할 수 있습니다.

K E Y W O R D S : Introduction to Computer, Pre-Service Teacher, ICT Subject, Textbook, Computer Science

[2*]**Corresponding author:** ***Seung Hyun, Kim (kimsh@knue.ac.kr)***

I. Introduction

Those who want to teach ICT subjects in secondary schools must have basic computer knowledge. It is impossible to contain all the knowledge about computers in one book. Still, in this book, we tried to cover the basic things you need to know before studying computers and computer science at an introductory level. In that sense, this study covers the fundamentals first by introducing basic computer science concepts and techniques before learning the computer science field [1].

Creating and disseminating online educational materials and spreading digital education infrastructure like e-learning systems through projects to improve ICT education capabilities in Cambodian Regional Teacher Training Center, Korea helps to provide high-quality education and to close the digital education gap [2].

This study intends to build the Introduction to Computer textbook for Pre-Service Teacher Education in Cambodia that the Korea International Cooperation Agency supports ICT curriculum development projects to expand ICT capabilities, particularly for pre-service teachers in Cambodia.

Ⅱ. Introduction to Computer Textbook in ICT RTTC Curriculum

The hours of Introduction to Computer textbooks are designed with 45 hours. The Introduction to Computer textbooks presents tweel chapters that follow a bottom-up arrangement of subjects that progresses from the concrete to the abstract.

Tab.1 Introduction to Computer Curriculum

Contents	Hours	
Chapter 1: Introduction to Computer Science 1. Introduction 2. The Role of Algorithms 3. The History of Computer 4. An Outline of our study 5. The Overarching Themes of Computer Science	1	45
Chapter 2: Mathematics for Computing 1. Introduction to Mathematics for Computing 2. Mathematic Datatype (Set) 3. Number Bases Systems 4. Logical	4	
Chapter 3: Computer Architecture 1. Introduction to Computer Architecture 2. The Architecture of Computer 3. Machine Language 4. Arithmetic/Logic Instruction	4	
Chapter 4: Operating System 1. Introduction to Operating System 2. History of Operating Systems 3. Structure of Operating System 4. Coordination of Computer Activity 5. Security	4	
Chapter 5: Network and Internet 1. Introduction to Network and Internet 2. The Internet 3. World Wide Web 4. Cyber Security	4	
Chapter 6: Algorithm 1. Introduction to Algorithm 2. Algorithm Representation 3. Algorithm Discovery 4. Iterative Structure 5. Recursive 6. Algorithm Analysis	4	
Chapter 7: Programming Language 1. Introduction to Programming Language 2. Generation of Programming Languages 3. Programming Paradigms 4. Block-Based Programming 5. Procedural Programming 6. Object-Oriented Programming 7. Database Query Language	4	
Chapter 8: Data Abstraction 1. Introduction to Data Abstraction 2. Basic Data Structure 3. Related Concepts 4. Customized Data Types 5. Classes and Objects	4	

Contents	Hours	
Chapter 9: Database Systems 1. Introduction to Database Systems 2. Database Fundamentals 3. Relational Model 4. SQL (Structured Query Language) 5. Object-Oriented Database 6. Data Mining	4	
Chapter 10: Software Engineering 1. Introduction to Software Engineering 2. Software Development Life Cycle 3. Software Engineering Methodology 4. Modularity 5. Software Analysis and Design Tools	4	
Chapter 11: Computer Graphics 1. Introduction to Computer Graphics 2. The Scope of Computer Graphics 3. 2D Graphics 4. Overview of 3D Graphics 5. Modeling 6. Rendering 7. Animation	4	
Chapter 12: Artificial Intelligence 1. Introduction to Artificial Intelligence 2. History of Artificial Intelligence 3. The Scope of Artificial Intelligence 4. Stage of Artificial Intelligence 5. Branches of Artificial Intelligence 6. Goals of Artificial Intelligence 7. Future of AI	4	

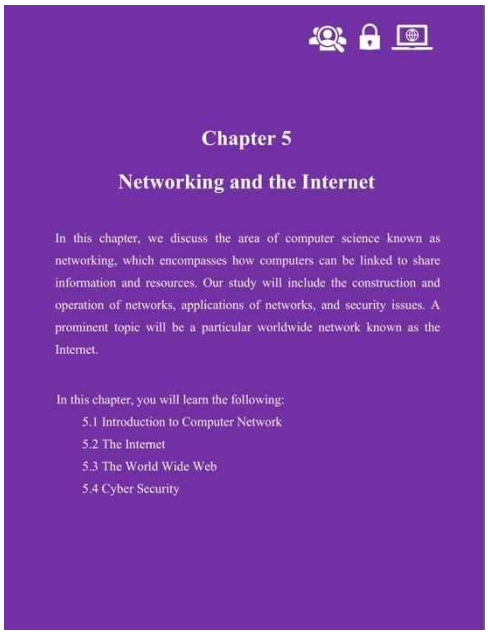
Ⅲ. Introduction to Computer Textbook Development

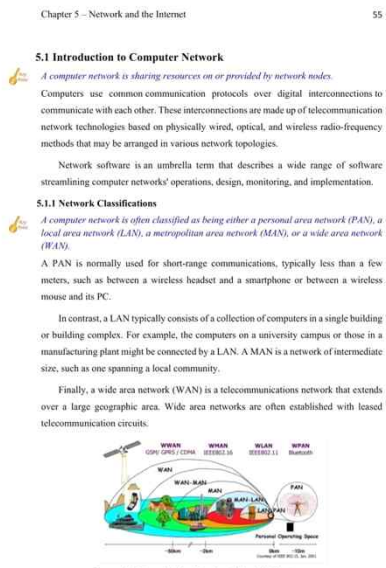
This textbook follows a bottom-up arrangement of subjects that progresses from the concrete to the abstract—an order that results in a sound pedagogical presentation in which each topic leads to the next: It begins with the fundamentals of information encoding, data storage, computer architecture, and mathematics for computing (Chapters 1 through 3); progresses to the study of operating systems (Chapter 4) and computer networks (Chapter 5); investigates the topics of algorithms, and programming languages (Chapters 6 and 7); explores techniques for enhancing the accessibility of information (Chapters 8 and 9); investigates of a software development project (Chapter 10); considers some significant applications of computer technology via graphics (Chapter 11) and closes with artificial intelligence (Chapter 12)[1].

On the opening page of each chapter, we have sections that cover topics of more specific interest or explore traditional issues in more depth. The **Introduction** opens

the discussion with representative problems to give the reader an overview of what to expect from the chapter. The **Key Points** highlight the essential concepts covered in each section. The **Chapter Summary** reviews the important subjects that students should understand and remember. It helps them reinforce the key concepts they have learned in the chapter. Also, at the end of each chapter are the **Questions and Exercises** in the Social Issues category to provide students with opportunities to apply the new skills they have learned independently. They are designed for thought and discussion. Many can be used to launch research assignments culminating in short written or oral reports[3]. A variety of supplemental materials for this textbook following are accessible to all readers. Chapter-by-chapter **Activities** extend topics in the text and provide opportunities to explore related issues. Chapter-by-chapter "**Self-tests**" help readers rethink the material covered in the text.

In addition, the following supplements are available to qualified instructors that provide access to the following resources: Syllabus, Lesson plan, PowerPoint lecture slides, Electronic guidelines, Instructor's Guide with answers to the Chapter Review Problems, and Additional resources at the https://sites.google.com/moeys.gov.kh/rttc-introduction-to-computer




Chapter 5 – Network and the Internet 55

5.1 Introduction to Computer Network

A computer network is sharing resources on or provided by network nodes.

Computers use common communication protocols over digital interconnections to communicate with each other. These interconnections are made up of telecommunication network technologies based on physically wired, optical, and wireless radio-frequency methods that may be arranged in various network topologies.

Network software is an umbrella term that describes a wide range of software streamlining computer networks' operations, design, monitoring, and implementation.

5.1.1 Network Classifications

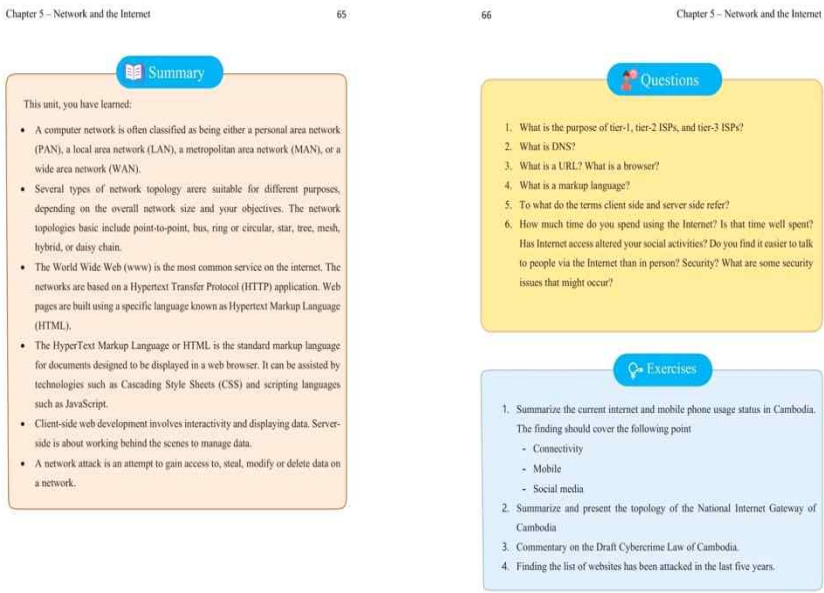
A computer network is often classified as being either a personal area network (PAN), a local area network (LAN), a metropolitan area network (MAN), or a wide area network (WAN).

A PAN is normally used for short-range communications, typically less than a few meters, such as between a wireless headset and a smartphone or between a wireless mouse and its PC.

In contrast, a LAN typically consists of a collection of computers in a single building or building complex. For example, the computers on a university campus or those in a manufacturing plant might be connected by a LAN. A MAN is a network of intermediate size, such as one spanning a local community.

Finally, a wide area network (WAN) is a telecommunications network that extends over a large geographic area. Wide area networks are often established with leased telecommunication circuits.

Figure 5.1: Network Classification (Wired/Wireless)



Chapter 5 – Network and the Internet 65

Summary

This unit, you have learned:

- A computer network is often classified as being either a personal area network (PAN), a local area network (LAN), a metropolitan area network (MAN), or a wide area network (WAN).
- Several types of network topology arere suitable for different purposes, depending on the overall network size and your objectives. The network topologies basic include point-to-point, bus, ring or circular, star, tree, mesh, hybrid, or daisy chain.
- The World Wide Web (www) is the most common service on the internet. The networks are based on a Hypertext Transfer Protocol (HTTP) application. Web pages are built using a specific language known as Hypertext Markup Language (HTML).
- The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.
- Client-side web development involves interactivity and displaying data. Server-side is about working behind the scenes to manage data.
- A network attack is an attempt to gain access to, steal, modify or delete data on a network.

66 Chapter 5 – Network and the Internet

Questions

1. What is the purpose of tier-1, tier-2 ISPs, and tier-3 ISPs?
2. What is DNS?
3. What is a URL? What is a browser?
4. What is a markup language?
5. To what do the terms client side and server side refer?
6. How much time do you spend using the Internet? Is that time well spent? Has Internet access altered your social activities? Do you find it easier to talk to people via the Internet than in person? Security? What are some security issues that might occur?

Exercises

1. Summarize the current internet and mobile phone usage status in Cambodia. The finding should cover the following point
   - Connectivity
   - Mobile
   - Social media
2. Summarize and present the topology of the National Internet Gateway of Cambodia
3. Commentary on the Draft Cybercrime Law of Cambodia.
4. Finding the list of websites has been attacked in the last five years.

Fig. 1 Example of a textbook for Introduction to Computer

IV. The Flow of Teaching and Learning for Introduction to Computer

The book is designed to be a course resource, not a course definition. We suggest encouraging students to read the material not explicitly included in your course. We underrate students if we assume we must explain everything in class. We should be helping them learn to learn on their own [1]. We can do better by presenting material from the student's perspective. So, we provide some materials to the instructor and learner that allows them easy-to-use resources to teach and learn from our textbook. The instructor can use PowerPoint lecture slides to teach pre-service students following Syllabus and Lesson plan.

Ⅴ. Conclusions

Cambodia's pre-service education ICT textbooks, which will be developed and used in Regional Teacher Training Center (RTTC), need to distribute curated learning materials that reconstruct and provide various information existing on the web, such as videos, images, articles, documents, diagrams, games, and practice questions, to suit the lecture theme. Through this study, with this textbook at the regional teacher training center (RTTC), the pre-service teachers will have full capacity to teach students at lower secondary schools.

References

[1]	Brookshear, J. G., & Brylow, D. (2018). *Computer Science: An Overview*. Pearson Education.
[2]	Norman, D.(2004). Emotional Design: Why We Love (or Hate) Everyday Things. New York: Basic Books.
[3]	Liang, Y. D. (2015). Introduction to Java Programming: Comprehensive Version. Pearson.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Artificial Intelligence Programming for ICT Pre-Service Teacher: In Case of Cambodia

Leang, Chhom[1], JunKi, Lee[2], In-Seon, Seo[2], and Kwihoon, Kim[3*]
[1]Ministry of Education Youth and Sport, Cambodia, ICT High School Teacher (chhom.leang.rttc@moeys.gov.kh)
[2]Department of Computer Education, Korea National University of Education, Graduate Student, (goodteacher1@knue.ac.kr)
[2]Department of Information Genius Education, Korea National University of Education, Graduate Student, (seoinseon86@gmail.com)
[3]Department of Computer Education, Korea National University of Education, Professor, (kimkh@knue.ac.kr)

ABSTRACT

The main purpose of the Artificial Intelligence Programming textbook is to enable Cambodian pre-service teachers studying at regional teacher training centers (RTTC) to familiarize and engage themselves with the artificial intelligence technology that is being widely used in our daily life. This book begins with an introduction to the basics of artificial intelligence, explaining the general concept of artificial intelligence and other related subsets fields under it. After introducing the basics of artificial intelligence technology, this textbook also presents real-world practical projects to show and implement for learners to see and understand more clearly. Through this book, initiated and supported by the Korea International Cooperation Agency (KOICA), Cambodian pre-service teachers will be able to understand artificial intelligence better and be able to share their knowledge with their students.

인공지능 프로그래밍 교과서의 주요 목적은 지역 교사 훈련 센터(RTTC)에서 공부하는 캄보디아 예비 교사들이 우리 일상 생활에서 널리 사용되고 있는 인공 지능 기술에 익숙해지고 참여할 수 있도록 하는 것입니다. 이 책은 인공 지능의 기본 개념에 대한 소개로 시작하여 인공 지능의 일반적인 개념과 그 아래에 있는 기타 관련 하위 집합 필드를 설명합니다. 이 교재는 인공지능 기술의 기초를 소개한 후 학습자가 보다 명확하게 보고 이해할 수 있도록 보여주고 구현하는 실제적인 실용적인 프로젝트도 제시합니다. 한국국제협력단(KOICA)이 시작하고 지원하는 이 책을 통해 캄보디아 예비교사들은 인공지능을 더 잘 이해하고 학생들과 지식을 공유할 수 있을 것이다.

K E Y W O R D S : Artificial Intelligence Programming, Artificial Intelligence, AI, regional teacher training centers, Pre-Service Teacher, ICT Subject, Textbook.

[3*]**Corresponding author:** ***Kwihoon, Kim (kimkh@knue.ac.kr)***

I. Introduction

Technology has rapidly developed day by day, and it plays a very important role in our daily life. As a result, our society has become so dependent on technology. Among the advanced technology that we use today, Artificial Intelligence (AI) has the potential to address some of the biggest challenges in all fields. To adapt to this evolution, we need human resources with AI knowledge; to accomplish this, we need teachers capable of teaching Artificial Intelligence.

Ⅱ. Artificial Intelligence Programming in Teacher Training Curriculum

The Artificial Intelligence Programming textbook was created with 3 credits (45 hours) of instruction divided into theoretical and practical parts, as shown in Table 1.

This Artificial Intelligence Programming Book was developed with the introduction to AI basics conception, experience with AI by seeing and implementing AI sample projects, and encouraging learners, especially pre-service teachers, to engage with AI technology. In this book, there are 12 chapters divided into two sections. The first section focuses on AI basics conception as the theory part, which is covered in chapters 1 through 4. In this paper, we provide a basic understanding of Artificial Intelligence, Educational Programming Language for AI Education [1-6], and how to write code in Scratch block-based programming [7]. Also, we demonstrate the real-world AI project to ensure our learners get familiar with AI, starting from chapters 4 to 12 as the practical part.

Tab.1 Artificial Intelligence Programming Curriculum

Contents	Hours	
Chapter 1 AI Basic Concept 1. Introduction to AI 2. History of Artificial Intelligence 3. Artificial Intelligence 4. Machine Learning 5. Artificial Neural Network 6. Multi-layer Neural Network 7. Deep Learning	6	45
Chapter 2: Machine Learning Methods 1. Introduction 2. Supervised Learning 3. Unsupervised Learning 4. Reinforcement Learning	1.5	
Chapter 3: Educational Programming Language for AI Education 1. Introduction 2. Teachable Machines 3. PRG AI Scratch 4. Entry 5. mblock5 6. Machine Learning for Kids 7. Machine Learning Platform Table	1.5	
Chapter 4: Scratch Block-Based Programming 1. Introduction 2. Computer Coding 3. Getting Started with Scratch 4. Scratch Workspace 5. Scratch Block Categories 6. Scratch Extensions 7. Getting Started with Scratch Code Blocks 8. First Project in Scratch	4	
Chapter 5: TM Sound: Project Rocket-loving Rainbow 1. Introduction 2. Creating a Model 3. Programming with Models 4. Conclusion	4	
Chapter 6: TM Sound Project: Text Abbreviation Test 1. Introduction 2. Creating a Model 3. Programming with Models 4. Conclusion	4	

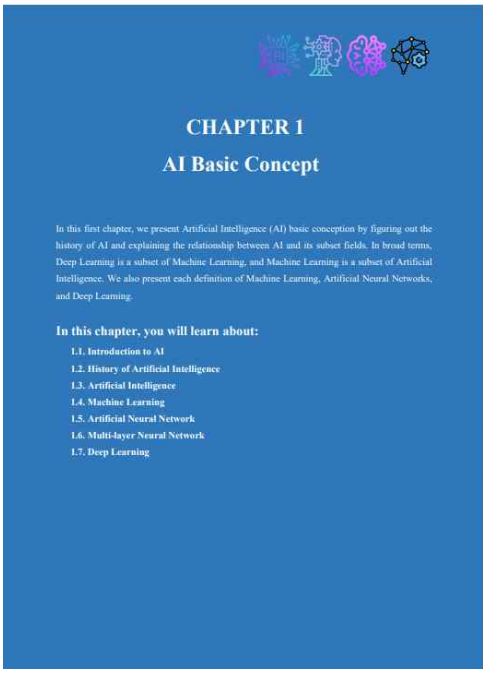
Contents	Hours	
Chapter 7: TM Image Project: A Fool Who Can't Even Tell the Difference Between an Apple and a Tomato 1. Introduction 2. Creating a Model 3. Programming with Models 4. Improving the Model 5. Conclusion	4	
Chapter 8: TM Image Project: Taking Care of a Virtual Companion Animal 1. Introduction 2. Creating a Model 3. Programming with Models 4. Ideas for Improvement 5. Conclusion	4	
Chapter 9: PRG AI Text Project: SNS Comment Sentiment Analyzer 1. Introduction 2. Rule-based Programming 3. Creating Model 4. Programming with Model 5. Conclusion	4	
Chapter 10: PRG AI Text Project: Travel Recommendation Chatbot 1. Introduction 2. Creating an Intentional Bias Model 3. Programming with the Model 4. Improving Model 5. Programming with Model 6. Conclusion	4	
Chapter 11: ENTRY Number Project: Hide-and-sick with the Ghost 1. Introduction 2. Experiencing the Game 3. Programming with the Model 4. Conclusion	4	
Chapter 12: ENTRY Number Project: The Fried Egg 1. Introduction 2. Experiencing the Game 3. Programming with the Model 4. Conclusion	4	

Ⅲ. Artificial Intelligence Programming Textbook Development

This Artificial Intelligence Programming textbook has been developed as the reference document used by the teacher training center in Cambodia. This book is designed to be easy for teachers and pre-service teachers to access. Each chapter is divided into three sections, the first section includes the title of the chapter, a brief goal of the chapter, and the last is the title of the points discussed in this chapter. The second section of the chapter is a detailed explanation of the whole content of each point, in the first section includes paragraphs, pictures, tables, and links. The last third part contains a lesson summary for a theoretical chapter or a conclusion for

the practical chapter, followed by comprehensive questions to ask the reader to clarify the understanding of the chapter, and finally, an exercise to expand Knowledge and increase further research on chapter content.

Fig. 1 Example of a textbook for Artificial Intelligence Programming



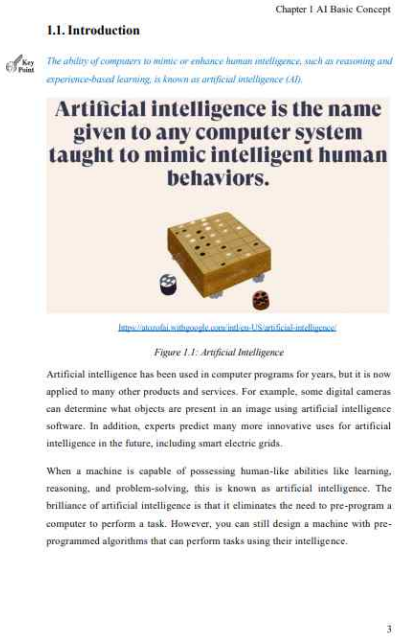
CHAPTER 1

AI Basic Concept

In this first chapter, we present Artificial Intelligence (AI) basic conception by figuring out the history of AI and explaining the relationship between AI and its subset fields. In broad terms, Deep Learning is a subset of Machine Learning, and Machine Learning is a subset of Artificial Intelligence. We also present each definition of Machine Learning, Artificial Neural Networks, and Deep Learning.

In this chapter, you will learn about:

1.1. Introduction to AI
1.2. History of Artificial Intelligence
1.3. Artificial Intelligence
1.4. Machine Learning
1.5. Artificial Neural Network
1.6. Multi-layer Neural Network
1.7. Deep Learning



1.1. Introduction

The ability of computers to mimic or enhance human intelligence, such as reasoning and experience-based learning, is known as artificial intelligence (AI).

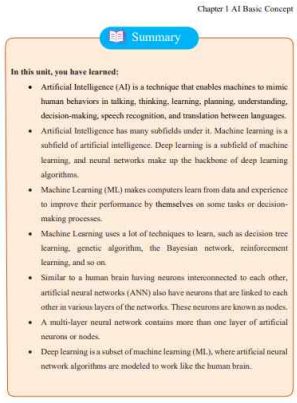
Artificial intelligence is the name given to any computer system taught to mimic intelligent human behaviors.

https://storyful.withgoogle.com/intl/en-US/artificial-intelligence/

Figure 1.1: Artificial Intelligence

Artificial intelligence has been used in computer programs for years, but it is now applied to many other products and services. For example, some digital cameras can determine what objects are present in an image using artificial intelligence software. In addition, experts predict many more innovative uses for artificial intelligence in the future, including smart electric grids.

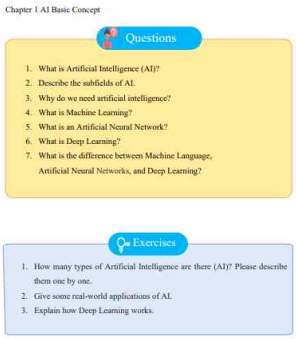
When a machine is capable of possessing human-like abilities like learning, reasoning, and problem-solving, this is known as artificial intelligence. The brilliance of artificial intelligence is that it eliminates the need to pre-program a computer to perform a task. However, you can still design a machine with pre-programmed algorithms that can perform tasks using their intelligence.



Summary

In this unit, you have learned:

- Artificial Intelligence (AI) is a technique that enables machines to mimic human behaviors in talking, thinking, learning, planning, understanding, decision-making, speech recognition, and translation between languages.
- Artificial Intelligence has many subfields under it. Machine learning is a subfield of artificial intelligence. Deep learning is a subfield of machine learning, and neural networks make up the backbone of deep learning algorithms.
- Machine Learning (ML) makes computers learn from data and experience to improve their performance by themselves on some tasks or decision-making processes.
- Machine Learning uses a lot of techniques to learn, such as decision tree learning, genetic algorithm, the Bayesian network, reinforcement learning, and so on.
- Similar to a human brain having neurons interconnected to each other, artificial neural networks (ANN) also have neurons that are linked to each other in various layers of the networks. These neurons are known as nodes.
- A multi-layer neural network contains more than one layer of artificial neurons or nodes.
- Deep learning is a subset of machine learning (ML), where artificial neural network algorithms are modeled to work like the human brain.



Questions

1. What is Artificial Intelligence (AI)?
2. Describe the subfields of AI.
3. Why do we need artificial intelligence?
4. What is Machine Learning?
5. What is an Artificial Neural Network?
6. What is Deep Learning?
7. What is the difference between Machine Language, Artificial Neural Networks, and Deep Learning?

Exercises

1. How many types of Artificial Intelligence are there (AI)? Please describe them one by one.
2. Give some real-world applications of AI.
3. Explain how Deep Learning works.

IV. The Flow of Teaching and Learning for Artificial Intelligence Programming

To use this textbook effectively in teaching and learning, teacher educator and pre-service teacher should try to read and understand the content of each chapter clearly and find other relevant documents for more understanding. Since this book has both theoretical and practical aspects, it requires the teacher educator who will teach this book to research and assign students as much practice as possible to expand their knowledge. Pre-service teachers, on the other hand, should try to practice the comprehensive questions and exercises after completing each chapter.

V. Conclusions

Through this book, we hope that all learners, especially pre-service teachers, will gain basic knowledge related to Artificial Intelligence Programming subjects to fully teach students about ICT subjects in lower secondary schools in Cambodia. Even though this book provides good material, we are sure that some points need to be added to some content due to the limited time required to develop this book.

References

[1]	Online: https://scratch.mit.edu/
[2]	Online: https://teachablemachine.withgoogle.com/
[3]	Online: https://playground.raise.mit.edu/
[4]	Online: https://playentry.org/
[5]	Online: https://machinelearningforkids.co.uk/
[6]	Online: https://ide.mblock.cc/
[7]	Online: https://brightchamps.com/blog/guides/scratch-programming/

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Educational Multimedia textbook for ICT Pre-service Teacher: In Case of Cambodia

Kompheak, Toy[1], and Sang-Mok, Jeong[2*]

[1]Ministry of Education, Youth and Sport, Cambodia, ICT Teacher Educator (toy.kompheak.rttc@moeys.gov.kh)
[2]Department of Computer Education, Korea National University of Education, Professor, (drcom@knue.ac.kr)

ABSTRACT

Information and Communication Technology (ICT) are important in today's development. The purpose of this textbook is to provide learners with a basic knowledge of ICT, including multimedia, computer graphics, and web programming. The Educational Multimedia textbook was designed with 3 credits (45 hours) for pre-service teacher trainee study in Cambodia. The Educational Multimedia textbook was developed by combining theory and practice in every chapter. Through this textbook, all learners, especially pre-service teacher trainees, will gain basic knowledge related to ICT subjects and be able to fully teach students about ICT subjects in lower secondary schools in Cambodia.

정보 통신 기술(ICT)은 오늘날의 발전에 중요합니다. 이 교재는 학습자에게 멀티미디어, 컴퓨터 그래픽, 웹 프로그래밍을 포함한 ICT의 기본 지식을 제공하는 데 목적이 있습니다. 교육용 멀티미디어 교과서는 캄보디아 예비 교사 연수생 학습을 위해 3학점(45시간)으로 설계되었습니다. 교육용 멀티미디어 교과서는 매 장마다 이론과 실습을 결합하여 개발되었습니다. 이 교재를 통해 모든 학습자, 특히 예비교사 연수생은 ICT 교과와 관련된 기본 지식을 습득하고 캄보디아 중학교에서 ICT 교과에 대해 충분히 가르칠 수 있을 것입니다.

K E Y W O R D S: ICT textbook, Educational Multimedia, Multimedia, Computer Graphics, Web Programming, Pre-service Teacher.

[2*]Corresponding author: *Sang-Mok, Jeong (drcom@knue.ac.kr)*

I. Introduction

Information and Communication Technology (ICT) are important in today's development. In education, ICT has significantly contributed to developing highly effective human resources. Therefore, as a teacher in this digital age, basic knowledge of the use of ICT is needed.

The Educational Multimedia textbook was developed to provide basic ICT knowledge to general learners, especially teacher trainees training at the Regional Teacher Training Centre (RTTC) in Cambodia. In this textbook, there are 13 chapters divided into three sections. The first section discusses multimedia, which is covered in chapters 1 through 3 [1]. This section provides a basic understanding of multimedia and how to use multimedia applications. The second section looks at computer graphics from chapters 4 to 8 [2]. The emphasis in computer graphics is on how to use Adobe Photoshop. And in the last section, from chapters 9 to 13, we consider web programming. The basics of HTML, CSS, and JavaScript are included in this section [3].

II. Educational Multimedia Textbook in RTTC ICT Curriculum

The Educational Multimedia textbook was designed with 3 credits (45 hours) for pre-service teacher trainee study in Cambodia.

Tab.1 Educational Multimedia Textbook Curriculum

Content	Hour	
Chapter 1: Introduction to Multimedia 1. What is multimedia? 2. Multimedia data compression	2	
Chapter 2: Audio,, Image, Video 1. Audio 2. Graphics and images 3. Video	2	
Chapter 3: Video Editor and Audio Editor 1. Video editor 2. Audio Editor	2	
Chapter 4: Introduction to Adobe Photoshop 1. What is Adobe Photoshop? 2. Early history 3. Version history 4. Photoshop system requirements 5. Getting start with Adobe Photoshop 2021 6. Interface layout	3	
Chapter 5: How to use Adobe Photoshop 2021 (1) 1. Palettes 2. Toolbox 3. Photoshop tools	4	
Chapter 6: How to use Adobe Photoshop 2021 (2) 1. Drawing and painting 2. Text	4	45
Chapter 7: How to use Adobe Photoshop 2021 (3) 1. Color boxes and modes 2. Image and color basics 3. Image adjustment	4	
Chapter 8: How to use Adobe Photoshop 2021 (4) 1. Filter and effects 2. Basic image editing 3. Correcting 4. Saving and exporting 5. Printing	4	
Chapter 9: HTML 5.0 and Install and Setup a Website on Windows 11 1. Website 2. Microsoft IIS (Internet Information Service)	4	
Chapter 10: HTML Elements, Tags and Attribute I 1. HTML 5 footer, header, nav, article, section and aside elements 2. HTML elements,, Tags and Attribute I	4	
Chapter 11: HTML Elements, Tags and Attribute II 1. HTML elements,, Tags and Attribute II	4	
Chapter 12: Introduction to CSS 1. Understanding CSS	4	
Chapter 13: JavaScript and DOM 1. JavaScript 2. HTML event and JavaScript	4	

Ⅲ. Educational Multimedia Textbook Development

The Educational Multimedia textbook was developed by combining theory and practice in every chapter. In the first part of each chapter, the objective is described for which the chapters will be given to students after completing them. Each chapter's theory and related content are written in the second part. In addition, practice exercises as examples for each point are added. At the end of each chapter, the main point, questions, and practice exercises are summarized to give students more practice.

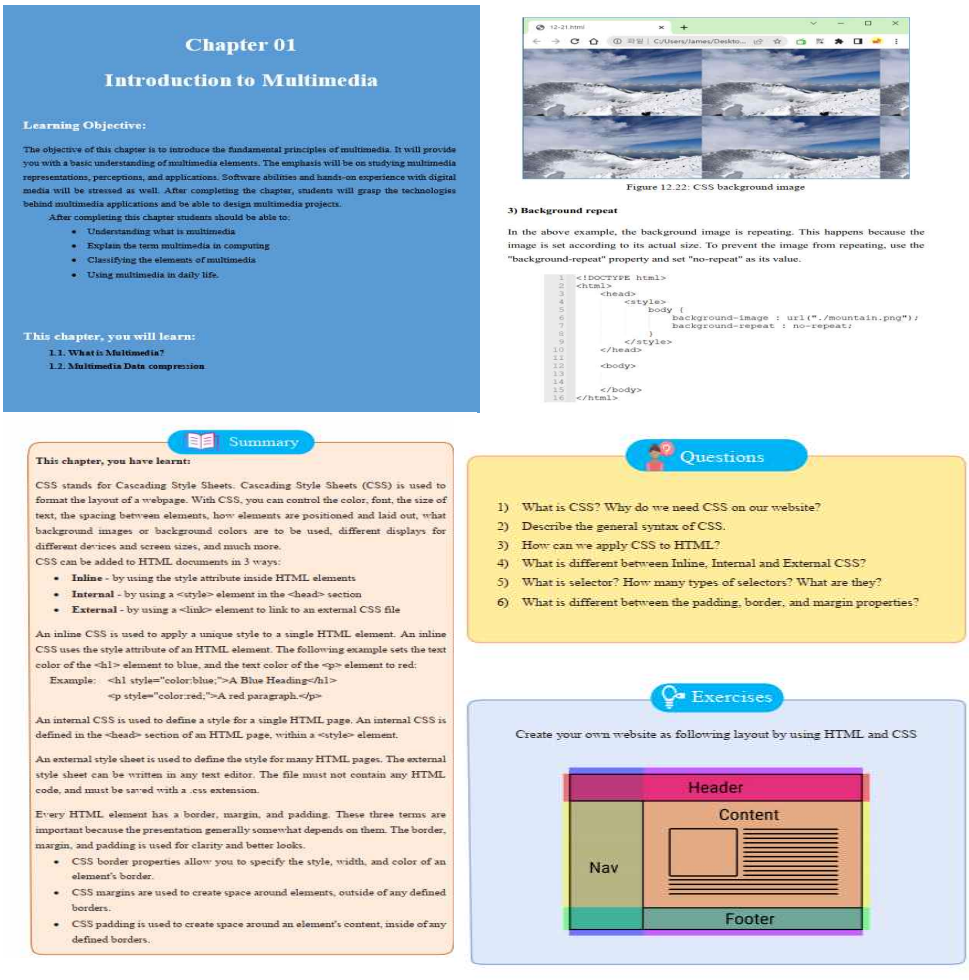


Fig. 1 Example of Educational Multimedia textbook

Ⅳ. The Flow of Teaching and Learning for Educational Multimedia

The flow of teaching and learning for Educational Multimedia is as follows: First, teachers teach the theory and do example practices for each chapter with students. Explain to them what each chapter is about. Second, students practice exercises using the knowledge they gain from the theory in each chapter. To learn this subject with good results, students must practice independently through the research and assignments provided for practice.

Furthermore, this textbook will provide learners, particularly instructors, access to the following resources to facilitate teaching and learning: a syllabus, lesson plan, PowerPoint lecture slides, electronic guidelines, and an instructor's guide with chapter review problem solutions.

Ⅴ. Conclusions

Due to the limited time required to develop this textbook, it still needs to improve in continuously improvement. Through this textbook, all learners, especially pre-service teacher trainees who study at Regional Teacher Training Center (RTTC) in Cambodia, will gain basic knowledge related to ICT subjects and be able to fully teach students about ICT subjects in lower secondary schools in Cambodia.

References

[1]	George Lekakos, Konstantinos Chorianopoulos, and Georgios Doukidis (2007). Interactive Digital Television: Technologies and Applications.
[2]	Online: https://helpx.adobe.com/photoshop/user-guide.html
[3]	Online: https://www.w3schools.com/

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of Digital Literacy Foundation Textbook for Pre-service Teacher: In Case of Cambodia

Phun, San[1], and Bok-Moon, Jung*[2*]
[1]*Korea National University of Education, Graduate Student, (san.phun.hs@moeys.gov.kh)*

[2]*Microdegree College, Shinhan University, Research Professor, (bokmoon.jung@gmail.com)*

ABSTRACT

The study aims to develop a Digital literacy foundation textbook as part of the Project for ICT Capacity Building of Lower Secondary Education in Cambodia, funded by the Korea International Cooperation Agency. The digital literacy foundation textbook focuses on basic knowledge to support the teaching and learning of Pre-service teachers. These include computer usage and maintenance knowledge and computer administration software to prepare documents for teaching and managing students and presenting. Software for electronic communication and online file transfer. Distance learning software and creating artificial classrooms. Cloud storage services to store files online. Evaluate media content, and create content for media. Ethics and security in the use of digital technology. Students can learn effectively and efficiently online and offline through textbooks with prepared study materials.

본 연구는 한국국제협력단의 지원을 받는 캄보디아 중학교 ICT 역량강화 사업의 일환으로 디지털 리터러시 기초 교재 개발을 목적으로 한다. 디지털 리터러시 기초 교재는 예비교사의 교육과 학습을 지원하기 위한 기본 지식에 중점을 두고 있습니다. 여기에는 컴퓨터 사용 및 유지 관리 지식과 학생을 가르치고 관리하고 발표하기 위한 문서를 준비하는 컴퓨터 관리 소프트웨어가 포함됩니다. 전자 통신 및 온라인 파일 전송용 소프트웨어. 원격 학습 소프트웨어 및 인공 교실 만들기. 파일을 온라인에 저장하는 클라우드 스토리지 서비스. 미디어 콘텐츠를 평가하고 미디어용 콘텐츠를 만듭니다. 디지털 기술 사용의 윤리 및 보안. 학생들은 학습 자료가 준비된 교과서를 통해 온라인과 오프라인에서 효과적이고 효율적으로 학습할 수 있습니다.

K E Y W O R D S : Digital literacy, Computer Usage and Maintenance, Media and Information Literacy, ICT Ethics, Textbook Development, Teacher Training

[2*]**Corresponding author:** ***Bok Moon, Jung*** ***(bokmoon.jung@gmail.com)***

Ⅰ. Introduction

To adapt to the world's 4.0 technology era and achieve the digital education goal set by the Ministry of Education, Youth, and Sports, teachers and trainees must know digital literacy and the skills they already have [1]. It does not require teachers and trainees to have a high level of knowledge in this field, but at least a basic level that can be used in the career path. This knowledge can help strengthen the quality and quantity and speed up the work of teachers and trainees in large part.

The documents related to digital technology in the Khmer language still need to be rich and lacking. Most of the documents are in foreign languages, which is why some scholars who do not know foreign languages can't understand the contents of those documents.

According to UNESCO, ‘Digital literacy’ refers to the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital devices and networked technologies for participation in economic and social life [2]. It includes various competencies: computer literacy, ICT literacy, information literacy, and media literacy.

This study intends to build the Digital Literacy Foundations textbook as part of the lower secondary education ICT curriculum development project financed by the KOICA. This study emphasizes expanding ICT capabilities, particularly in Cambodia.

Ⅱ. Digital Literacy Foundation Textbook Development

The book ‘Digital Literacy Foundation’ was written specifically for teachers and trainees interested in learning about digital literacy [3]. The content of this book focuses on the basic knowledge that needs to be used in daily work and includes computer usage and maintenance knowledge, computer administration software to prepare documents for teaching and managing students and presenting, software for electronic communication and online file transfer, distance learning software and creating artificial classrooms, cloud storage services to store files online, evaluate media content, and create content for media, and ethics and security in the use of digital technology [4-5].

Digital literacy foundation is divided into four parts as follows.

3.1 ICT Basic

The first section focuses on knowledge of technology and communication, such as the basics of computer use. In particular, focus on the use of office applications such as Writer, Calc, and Impress. Use of the Internet and email applications are also included in this section, along with the use of the Google Suite for Education. The above knowledge is important for every teacher and is a step towards the qualifications of a digital teacher [6-7].

3.2 Media and Information Literacy

This section refers to the study of various forms of media and the evaluation of true or false information available on those media. knowledge to share safe and useful content and information. Especially with the knowledge to create digital content such as video, audio, and video production [8].

3.3 ICT Ethics

This section refers to the safe use of digital technology and is within the limits of ethics. Understand the privacy of individuals and society in the use of data. Understand the benefits of self-defense online. On the other hand, make students aware of intellectual property laws and piracy.

3.4 Computer Maintenance

This section focuses on pre-service teachers who major in ICT. but other learners can study as well. Important knowledge in this area includes knowledge of computer hardware and software to capitalize on troubleshooting computer problems, knowing various operating systems, and knowing how to install operating systems or computer programs. In addition, students understand computer maintenance and lab setup.

The Part of the textbox is as follows and in shown as Figure 1. The Cover Page first determines the section's title, introduction, learning purpose, and content. Second, to provide the reader a preview of what to expect from the chapter, the Introduction begins the discussion with illustrative issues that include motivation and essential concepts. Third, the practice section of the lesson focuses on learning exercises to

help students comprehend each content area, such as subject matter knowledge, pedagogical content knowledge, and pedagogical knowledge. Fourth, a Chapter Summary summarizes the chapter's most important ideas about the course. The chapter also includes a set of questions and exercises that can be used as a teaching tool. In other cases, it may be in the form of homework or assignments. Thus, it fosters an environment where students can be independent learners and learn in a manner that encourages personal development. By doing this, learners can become more motivated, recognize their strengths and shortcomings, improve their academic performance, cultivate critical thinking and problem-solving abilities, and foster a lifelong love of learning.

Ⅲ. The Flow of Teaching and Learning for Digital Literacy Foundation

First, students listen to the teacher explain the lesson and observe the teacher's practice on the board. Students then begin to apply the lessons they have observed. During practice, the teacher acts as an assistant to help students when they have a problem. Some lessons require students to do more research on the Internet.

Ⅳ. Conclusions

Cambodia's lower secondary education ICT textbooks, which will be developed and used in the future, need to distribute curated learning materials that reconstruct and provide various information existing on the web, such as videos, images, articles, documents, diagrams, games, and practice questions, to suit the lecture theme. Through this, students can learn efficiently and effectively online and offline.

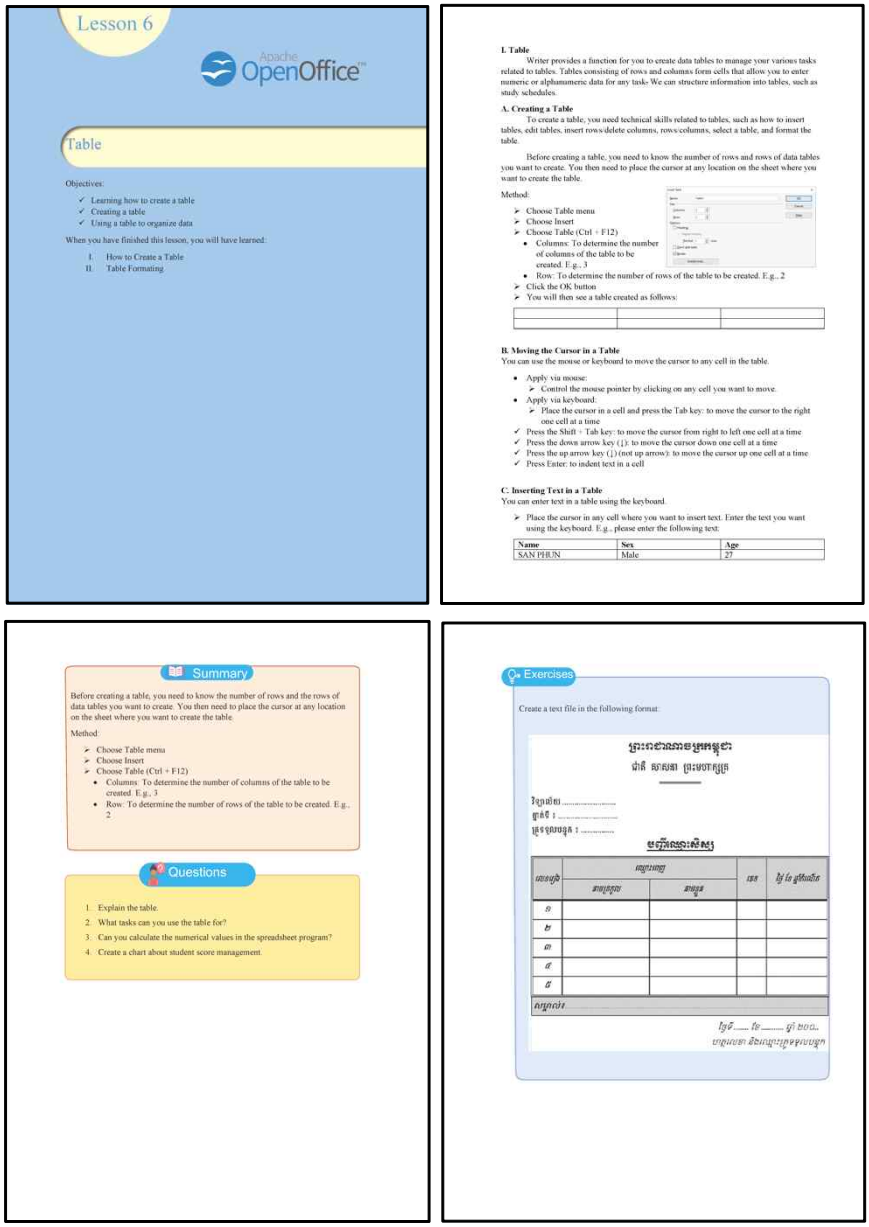


Fig1. Example of Digital Literacy Foundation Textbook

References

[1]	Moeys & Open Institute. (2012). Computer book for teaching and learning, Window OS (3rd ed.) Phnom Penh, Cambodia
[2]	Antoninis, M., & Montoya, S. (2018, March 19). A global framework to measure Digital Literacy. Retrieved December 20, 2022, from https://uis.unesco.org/en/blog/global-framework-measure-digital-literacy
[3]	Sylvia, B., & Thorsten, K. (2021, January). Media and information literacy: A practical guidebook for trainers. (3rd ed.) Deutsche Welle, 53110 Bonn, Germany
[4]	Ireton, C., & Posetti, J. (2018). Journalism, 'fake news' & disinformation: Handbook for journalism education and training. Paris: United Nations Educational, Science, and Cultural Organization.
[5]	Wempen, F. (2015). Digital Literacy for dummies. Hoboken, NJ: John Wiley & Sons.
[6]	Leonhard, W. (2018). Windows 10 all-in-one for dummies. Hoboken, NJ: John Wiley & Sons.
[7]	NiDA & the WordForge Foundation. (2006). Manual guide for Khmer Open Office(1st ed.) Phnom Penh, Cambodia
[8]	Morrison, C., Wells, D. J., & Ruffolo, L. (2015). Computer Literacy Basics: A comprehensive guide to IC3. Stamford, CT, USA: Cengage Learning.

한국에듀테인먼트학회 Korea Edutainment Society
Journal of the Edutainment
한국에듀테인먼트학회 동계학술대회 (2023)
ISSN 2671-9789(Print) 2672-0329(Online)
http://www.koedus.com

Development of ICT for STEM and Innovation Chapter in ICT textbook for Lower Secondary Education: In Case of Cambodia

In-Seong Jeon*[1] , and Ki-Sang Song[2*]
[1]*Department of Computer Education, Korea National University of Education, Researcher, (jinsung4069@knue.ac.kr)*

[2]*Department of Computer Education, Korea National University of Education, Professor, (kssong@knue.ac.kr)*

ABSTRACT

This study intends to build the ICT for STEM and Innovation Chapter as part of the lower secondary education ICT curriculum development project financed by the Korea International Cooperation Agency. ICT for STEM and Innovation presents the use of ICT in STEM, Physics, Chemistry, Biology, Earth Science, and Mathematics. It is shown that the composition of the 7th-grade ICT for STEM and Innovation and the flow of teaching and learning for ICT for STEM. Through the textbook with curated learning materials, students will be able to learn efficiently and effectively online and offline.

본 연구는 한국국제협력단에서 지원하는 중학교 ICT 교과과정 개발사업의 일환으로 STEM과 혁신을 위한 ICT 장을 구축하고자 한다. STEM 및 혁신을 위한 ICT는 STEM, 물리학, 화학, 생물학, 지구 과학 및 수학에서의 ICT 사용을 제시합니다. STEM과 혁신을 위한 7학년 ICT의 구성과 STEM을 위한 ICT 교수학습의 흐름을 보여준다. 큐레이팅된 학습 자료가 포함된 교과서를 통해 학생들은 온라인과 오프라인에서 효율적이고 효과적으로 학습할 수 있습니다.

K E Y W O R D S : ICT Education, STEM Education, Textbook Development, Lower Secondary Education, ODA

[2]***Corresponding author:** ***Ki-Sang Song**[*] (kssong@knue.ac.kr)*

Ⅰ. Introduction

To adapt to the fast-changing social environment, such as the fourth industrial revolution, Cambodian talent with ICT skills must be developed. Students with the talents and skills sought after in recent worldwide computer education must also be developed[1].

By creating and disseminating online educational materials and spreading digital education infrastructure like e-learning systems through projects to improve ICT education capabilities in Cambodian lower secondary schools, Korea helps to provide high-quality education and close the digital education gap[2].

This study intends to build the ICT for STEM and Innovation Chapter as part of the lower secondary education ICT curriculum development project financed by the Korea International Cooperation Agency. This study emphasizes expanding ICT capabilities, particularly in Cambodia.

Ⅱ. ICT for STEM and Innovation in Lower Secondary ICT Curriculum

The hours of ICT for STEM and Innovation are assigned 22, 20, and 18 hours for each grade. ICT for STEM and Innovation presents the use of ICT in STEM, Physics, Chemistry, Biology, Earth Science, and Mathematics[3].

Tab.1 ICT for STEM and Innovation Curriculum

Grade	Domain	Content	Hour	
7	ICT for STEM	**Lesson 1: Using Technology for STEM** 1. Introduction 2. Description on the Importance of Technology and STEM 3. Recommendation of main technologies for STEM Education 4. STEM-technology Innovation	2	
		Lesson 2: ICT for Physics 1. Experiment on Measuring Electrical Current 1.1. Voltage Measurement 1.2. Resistance Measurement 2. Electrification 3. Exercises 4. The Use of Technology Application to Demonstrate Measuring Electrical Current Experiment	4	
		Lesson 3: ICT for Chemistry 1. Video File Types 2. Changing States of Matter 3. Composition of Air 4. Using Technology Applications to Demonstrate Changing States and the composition of air	4	
		Lesson 4: ICT for Biology 1. Cells 1.1. Forms of Cells 1.2. Types of Cells 1.3. Cell Elements (Organelle) 2. Invertebrate 2.1. Common Characteristics 2.2. Types of Invertebrates 3. The Use of "Quiver App" or Other Similar Applications	4	2 2
		Lesson 5: ICT for Earth Science 1. Galaxies 2. Solar System Planets 3. Using Technology to Show Galaxies and Planets	2	
		Lesson 6: ICT for Mathematics 1. Calculate the Volume of Solids 2. Statistical Graphs 2.1. Bar Graph 2.2. Pie chart 2.3. Line Chart 3. Interest rates 4. Reflection 5. The Use of 'GeoGebra' and 'Sketchpad' Application	6	

Ⅲ. ICT for STEM and Innovation Textbook Development

The composition of the 7th grade ICT for Physics Lesson of ICT for STEM and Innovation is as follows. First, it guides the subject of the lesson and the learning goal. Second, since ICT for Physics Lesson is focused on practice, it consists of motivation, key terms, practice contents, problem-solving, self-evaluation, summary, and practice problems for conducting practice.

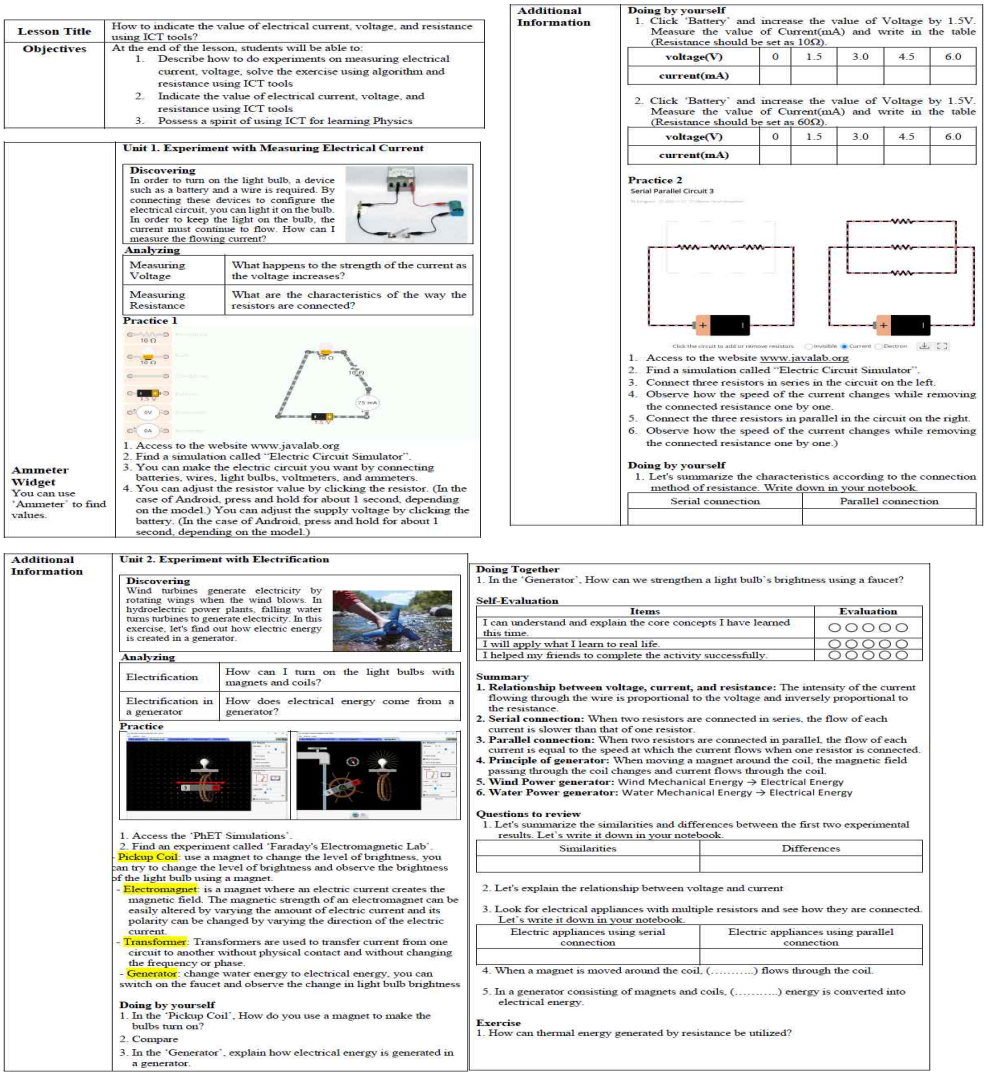
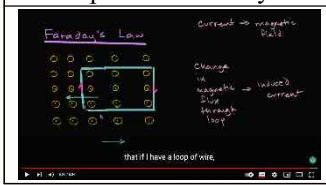
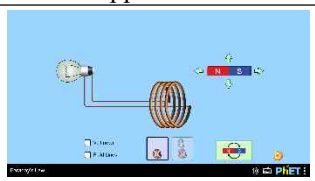
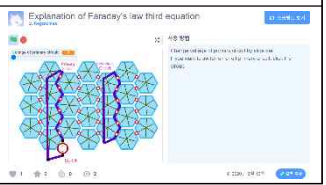


Fig. 1 Example of a textbook for ICT for Physics Lesson in the 7th grade

Ⅳ. The Flow of Teaching and Learning for ICT for STEM

The flow of teaching and learning is as follows. First, students watch the video and explain the theory about Measuring Electrical Current students learned in a science subject. Second, students practice using the web or mobile applications (combining STEM elements such as physical simulation, math, art, music, etc.). If there is no suitable application, students construct simulations, stories, etc., related to what they have learned and implement it by coding through scratch programming (e.g., programming the relationship between voltage and current with scratch).

Tab.1 The Flow of Teaching and Learning

Watch the video and explain the theory	Practice using the application	Scratch programming
		

Ⅴ. Conclusions

Cambodia's lower secondary education ICT textbooks, which will be developed and used in the future, need to distribute curated learning materials that reconstruct and provide various information existing on the web, such as videos, images, articles, documents, diagrams, games, and practice questions, to suit the lecture theme. Through this, students will be able to learn efficiently and effectively online and offline.

References

[1]	Kim, B. G.(2002). A Study on the Contents Online Computer Games, Master`s Degree Dissertation Entertainment University. **(Times New Roman, 10pt)**
[2]	Norman, D.(2004). Emotional Design: Why We Love (or Hate) Everyday Things. New York: Basic Books.
[3]	Online: http://www.google.com/abc/efg
[4]	Alonso, A. C., Brech, G.C., Bourquin, A.M.(2011). The Influence. Journal of Korean, 129(6):410-421.