

Part B Project Summary

(Revised)

Project Title: Developing a Community of Practice of Flipped Learning for ICT Teachers (建立資訊及通訊科技翻轉學習教師專業社群) **Project Number** 2016/0230

Name of Organization: Information Technology Discipline, the Hong Kong Institute of Vocational Education

- (1) **Goals:** To develop a community of practice (CoP) which promotes ICT teachers to use flipped learning approach for the delivery of the senior secondary ICT curriculum.
Objectives: (i) To promote student-centered learning for the development of domain knowledge; (ii) To encourage teachers and students to adopt active and interactive learning pedagogy; (iii) To develop learning and teaching materials for supporting student-centered learning
- (2) **Targets:** ICT teachers from the senior secondary schools in Hong Kong
Expected number of beneficiaries: (a) Direct: Around 60 ICT teachers and their 1,200 students from senior secondary schools; (b) Expected: All ICT teachers and students from senior secondary schools in Hong Kong
- (3) **Implementation Plan - Duration:** January 2018 to December 2019 (2 years)
 - (i) **Process/ Schedule:**

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|---------|--|
| 01 – | Formation of CoP; teacher development activities (TDA) for startup of flipped learning (FL) and selection of |
| 02/2018 | topics within ICT curriculum for FL; Staff recruitment; Procurement of equipment |
| 03 – | Development of learning and teaching materials (LTM) for the 1 st set of topics; TDA on flipped learning with |
| 04/2018 | the LTM; first public seminar; Development of the website of the CoP |
| 05 – | FL on the pilot set of topics as pilot run; students' assessment (SA) for the pilot set of topics |
| 06/2018 | |
| 07 – | Focus group interviews with teachers; Development of LTM for the pilot set of topics; TDA on flipped learning |
| 08/2018 | with the LTM; Improvement of LTM for the pilot set of topics |
| 09 – | FL on the 1 st set of topics; Pre-tests for students on SA for the 1 st set |
| 12/2018 | of topics; Development of LTM for the 2 nd set of topics; TDA on flipped learning with the LTM |
| 01 – | FL on the 2 nd set of topics; Focus group interviews with teachers; Improvement of LTM for the 1 st set of |
| 06/2019 | topics; Tests for SA for the 2 nd set of topics; Students' perception questionnaires |
| 02- | Focus group interviews with teachers; Improvement of LTM for the 2 nd set of topics; Development of |
| 08/2019 | learning and teaching materials for the 3 rd set of topics with review by teachers |
| 09 - | FL on the 3rd set of topics; SA for the 3rd set of topics |
| 11/2019 | |
| 10 – | Focus group interviews with teachers; second public seminar; Improvement of LTM for all topics; TDA on |
| 12/2019 | flipped learning with the LTM; Completion of the CoP website; Overall evaluation report |
 - (ii) **Collaboration with other parties/partners:** 33-40 secondary schools in Hong Kong and Association of IT Leaders in Education
- (4) **Products:**
 - (i) **Deliverables/outcomes:** (a) A CoP for ICT teachers; (b) 11 teacher development activities including two public seminars; (c) A website of e-learning materials; (d) Evaluation Report
 - (ii) **Dissemination of deliverables/outcomes:** (a) Public seminars in local region; (b) Academic publications in the local region; (c) A CoP for ICT teachers; (d) A website of e-learning materials
- (5) **Budget:** (a) staff cost: \$3,812,376; (b) equipment: \$37,104; (c) services: \$168,300; (d) works: \$0; (e) general expenses: \$56,078; and (f) contingency: \$7,842
- (6) **Evaluation:**
 - (i) **Performance indicators:** (a) Changes of students' learning attitude from passive to active and interactive; (b) Students' academic performance in the selected topics of the senior secondary ICT curriculum
 - (ii) **Outcome measurements:** (a) Focus group interviews with teachers; (b) Questionnaire surveys on students' perception; (c) Comparison of students' self-directed learning readiness before and after flipped learning; (d) Students' test scores in the selected topics of the senior secondary ICT curriculum

1. Needs Assessment and Applicant's Capability

1.1 Needs Assessment

Social Needs of IT Talents

With the advancement of digital technologies, IT skills become essentials in practically all economic sectors and daily life of people. According to Financial Secretary of HKSAR (2015):

“A new wave of entrepreneurship, in the form of start-ups, is emerging around the world. Many start-ups boldly apply new technologies, information technology in particular, disrupting the traditional mode of operation. They translate state-of-the-art technologies into competitive products and services that change consumption patterns and open up new markets.”

The HKSAR Government has determined to develop Hong Kong into a knowledge-based economy and an innovation hub for technology and its application in the region. The Innovation and Technology Bureau has been recently established to promote the development of innovation and technology and information technology which are the key drivers in this endeavour. The EDB will promote STEM education by renewing and enriching the curricula and learning activities of Science, Technology and Mathematics (Policy Address, 2015; CDC, 2015). Financial Secretary (2016) announced plans of more than \$17 billions for nurturing innovation. Shortage of IT talents in Hong Kong has been reported in many local news articles and manpower reports. The demand of IT talents will continue to increase as IT is a key driver of innovation and economic development.

Problem-solving and coding skills become very important nowadays. These skills are strongly promoted in many countries, such as US and UK. According to Re/code (2015), the US President Obama said “Everybody’s got to learn how to code early.” According to Education Bureau (2015), “there is a great need to strengthen digital literacy, self-directed learning, collaboration and problem-solving competency as well as creative and innovative thinking skills of our students” and “teachers and the IT industry generally agree to include programming in the secondary curriculum and consider it mandatory in the junior secondary curriculum.” The report states that “EDB will continue to enhance students’ problem-solving skills through equipping them with programming-related capabilities (e.g. computational thinking, modelling, coding, testing, and analysing).” In addition, the Government has proposed to add IT enrichment programmes in secondary schools (Financial Secretary, 2014) for attracting talented students for pursuing careers in IT.

With the IT-enriched learning environment in schools, it becomes cost-effective to adopt self-directed learning approaches (e.g. flipped classroom) in schools, with the aid of e-learning materials. In fact Education Bureau (2015) has aimed to strengthen students’ self-directed learning, problem-solving, collaboration and computational thinking competency, to enhance their creativity and innovation, and even entrepreneurship, as well as to nurture the students to become ethical users of IT for pursuing life-long learning and whole-person development through leveraging technology and the capacity of IT.

The interest in adopting Flipped Learning by teachers and students has been growing rapidly in recent years. Of the more than 180,000 middle and high school students who participated in the Speak Up 2013 surveys, almost three-quarters agreed that Flipped Learning would be a good way for them to learn, with 32% of those students strongly agreeing with the idea (Yarbro et al., 2013). The number of members of the Flipped Learning Network has grown from 2,500 in January 2012 to more than 20,000 as of May 2014 (Yarbro et al., 2013). With Flipped Learning, the core learning materials are delivered through viewing video clips prior to attending classes. Hence, the class time can be devoted to higher level learning activities, such as the application of the learning materials in problem solving, group discussions and collaborative learning with instant feedback and coaching support from teachers. Flipped learning facilitates active learning and higher-level learning with support by teachers and their classmates. According to an online survey on 2,358

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Presenting interactive and animated materials is effective for making learning memorable and assisting learning (Balci et al., 2001). Although interactive and animated learning materials are available in the Internet, the learning materials cover a small set of topics of the Hong Kong senior secondary ICT curriculum and needs a lot of customization for suiting the level and learning needs of students. For example, the materials for teaching computer science cover a range of relevant topics. However, the learning materials only cover limited topics of the senior

educators conducted in 2014, the Flipped Learning Network and Sophia Learning found that flipped teachers in science, technology and computer science were 17%. One out of ten teachers received their own professional development in a flipped fashion (Yarbro et al., 2013). Many studies have shown that flipped learning can improve students' learning. Math teachers at Niagara Falls High School (New York) flipped their class in 2013. After implementing the flipped approach, 83% of students in the honors Algebra II/Trigonometry class passed the Regents exam (with a score of 65 or higher) compared with 71% the year before, and 35% of honors students achieved mastery (a score of 85 or higher) compared with 14% the previous year (Yarbro et al., 2013). Bidwell (2014) reported that "At Villanova, Weinstein helped lead a pilot program for flipping engineering courses. New data from the program given to U.S. News shows the bottom third of students' scores improved by 10% after the program. The difference between a D+

secondary ICT curriculum. The project has the following innovation for students' learning in the senior secondary ICT curriculum of Hong Kong:

- Shift from passive learning approach to active, interactive, student-directed and higher level learning approach
- Interactive learning materials for student's preparation before class. The learning materials are designed to suit the characteristics of students: short concentration time, preference of quick feedback and preference of "doing" than "pure reading and watching":
 - Video clips with questions to ensure students watch video clips and collect students' learning progress for teachers' preparation of classroom activities
 - Web-based visualization of program execution for helping students to understand what happens as the computer executes each line of a program's source code. Students can view the values of internal variables, output and current location of the control flow of the program after the execution of each line of program's source code. Two examples of visualization of program execution are given Appendix 4.
 - Web-based simulation of execution of programming constructs (e.g. if-else statement, iteration, etc.) and fragment of program code. Students can view the effect of the execution of a single statement and a group of statements. They can also adjust the values of some parameters (variables or constants) to experiment how the execution of statements would change with the values of the parameters.
 - Web-based animation. Animation will be designed and developed for helping students to understand computer concepts, e.g. programming tracing and algorithm tracing.
 - Visualization of execution of flow chart (Xinogalos, 2013) for helping students to understand algorithm design and testing. Student can use a flow chart interpreter to design an algorithm, and execute the algorithm step-by-step and visualize the results of the execution.

Conceptual Framework

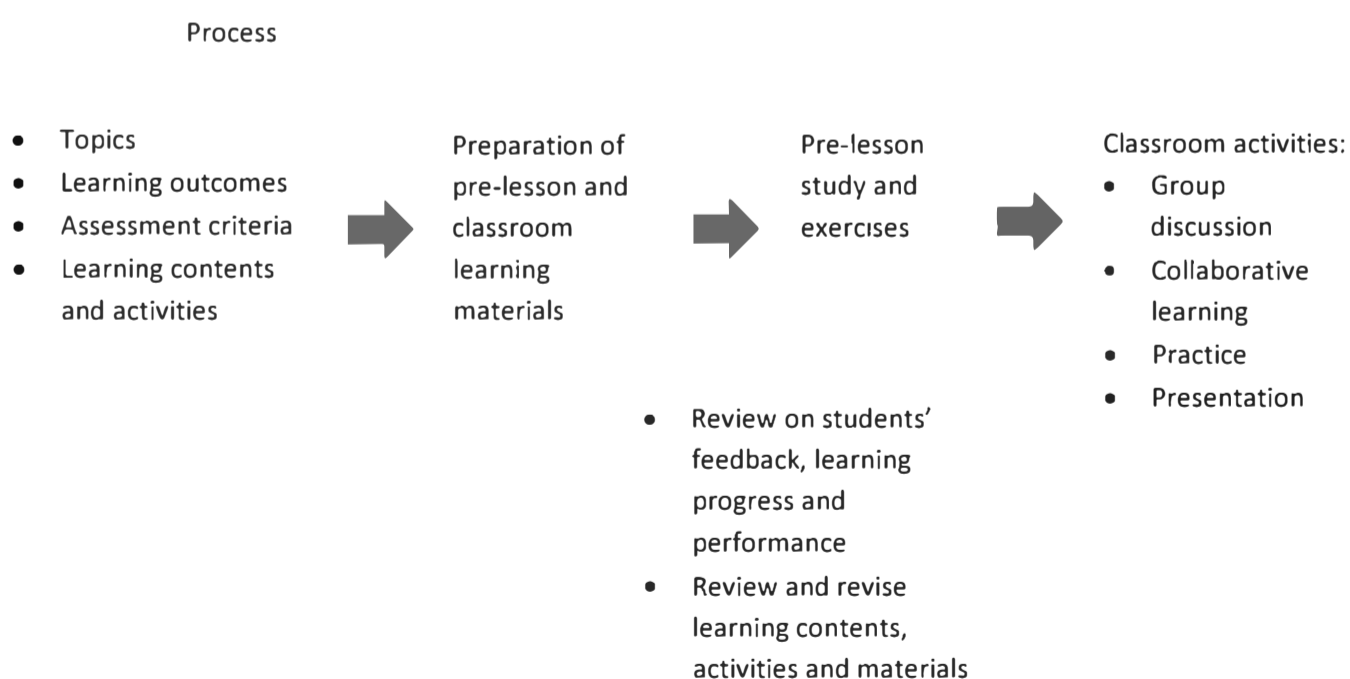


Figure 1: Process of Flipped Learning

Topics of the senior secondary ICT curriculum will be selected for the development of flipping learning materials. For each selected topic, the learning outcomes of the topic defined in the senior secondary ICT curriculum are identified. Then assessment criteria for the learning outcomes will be identified from the Information and Communication Technology Curriculum and Assessment Guide. Finally, the learning

activities and materials will be designed according to the learning outcomes and assessment criteria. The process of flipped learning is illustrated as the diagram in Figure 1 above.

The learning materials are uploaded to a learning management system (e.g.). During pre-lesson study, students access the learning management system to learn knowledge by watching video clips with narrative IT concepts and examples, reading materials, and using the interactive web-based learning materials (e.g. visualization of the flow and sequence of program execution, simulations, animations). They can also attempt the pre-study exercises by using mobile devices or computers with internet connection. The responses of the pre-study exercises are collected and analyzed automatically by the learning management system. The teacher can then adjust the learning activities in classroom according to the results of pre-study exercises to correct their misconceptions or misunderstandings and enhance conceptual understanding. More importantly, the teacher can moderate classroom discussions for engaging students in learning. After the classroom activities or assessments, the teacher and the community of practice review the students' learning progress, performance and feedbacks from students and revise the learning contents, activities and materials for continuous improvement. The following table (UTEXAS) shows the comparison between the learning process of traditional teaching method and flipped learning:

| Time | Traditional Teaching Method | Flipped Learning |
|--------------|---|---|
| Before Class | Students read pre-study materials. | Students watch videos, read materials, use interactive learning materials and complete pre-study exercises. |
| | Teacher prepares lecture. | Teacher reviews the results of students' pre-study exercises and questions and adjusts learning contents and activities. |
| During Class | Teacher tries to go through all materials and leaves less time for answering students' questions, feedbacks to students and students' practice. | Students ask specific questions. |
| | Students try to follow along. | Teacher answers students' questions and guides through specific learning materials which students found difficult in pre-study. More importantly, the teacher can moderate classroom discussions for engaging students in learning. |
| | Teacher has less time and freedom to spend with each student. | Students have more time to practise the skills and they are expected to learn and get more feedback from teacher. |
| | | Teacher has more time and freedom to decide upon how much time to spend with each student. |
| After Class | Students attempt the homework, usually with delayed feedback. | Students continue applying their knowledge and skills in more comprehensive exercises after clarification and feedback. |
| | Teacher grades less comprehensive work. | Teacher posts any additional explanations and resources as necessary and evaluates higher quality work. |

With traditional teaching method, teacher usually goes through all materials in traditional lectures. Over the past 30 years, traditional lecture has been strongly criticized in the following aspects (Nouri, 2016; Cashin, 1985; Bonwell, 1996; Huxham, 2005; Young, Robinson & Alberts, 2009):

- Students are passive in traditional lectures due to lack of mechanisms for engaging students.
- Student's attention wanes quickly.

- The pace of the lectures cannot cater to the learning needs of all students.
- Traditional lectures are not suited for teaching higher order skills such as application and analysis.

In a flipped-learning environment, the content delivery and lower-order thinking happens outside the class, and the difficult part of learning happens in the class where the teacher is able to assist the students, but in many traditional classes, students are sent home to wrestle with the difficult part by themselves. Flipped learning engages students in more effective, active, motivating, supportive learning, especially for weaker students who may struggle with traditional lectures (Nouri, 2016). Flipped learning is better than traditional teaching method in the following ways:

- Teacher can better cater the learning needs of individual students. Struggling students and great performers can get the necessary feedback and help from teacher.
- Once a video lecture is prepared, it can be reused as many times until the content becomes outdated.
- Students, especially weaker students who might find traditional lectures challenging and fast-paced (Young et al., 2009), can pause and rewind the video lectures for gaining more opportunities to reflect and learn in their own pace.
- Students learn deeper through more comprehensive exercises or practices. They would be more confident about learning since they can get more feedback and help more timely from teacher in classroom.
- Students, who are absent, can catch up with their peers faster and easier with the flipped learning approach than with the traditional one.
- Students play an active role in learning and develop their self-directed learning skills.
- Students would be more self-motivated to learn as participating in flipped learning.

The following table shows an example of learning activities for topic “Selection Statements” of the Elective Part (D) – Software Development of the Senior Secondary ICT Curriculum.

Topic: “Selection Statements” of the Elective Part (D) – Software Development of the Senior Secondary ICT Curriculum.

| Time | Activities |
|--------------|---|
| Before class | <ul style="list-style-type: none"> • Students view video lectures and lecture notes for achieving an understanding of the use of “SELECTION” statements and meaning and syntax of selection statements. • Students use web-based visualizer to run sample code fragments of selection statements and watch the results. The online learning materials guide the students to input different values of variables and see how the execution of selection statements changes with the values of variables. • Students complete and submit the pre-study exercise using the learning management system. • Teacher checks the students’ answers in the pre-study exercise and prepares subsequent class to reinforce student understanding of specific content they found difficult. |
| During class | <ul style="list-style-type: none"> • Teacher addresses students’ questions which were submitted previously or are raised in class by inviting students in the class to respond. The teacher can explain specific content by using their proper responses and rectifying their misunderstandings. • Students can practise their skills and present their answers in groups. • Teacher can moderate the classroom discussions. • Teacher monitors the students’ learning progress in classwork and helps individual students who have learning difficulties. • Teacher provides feedbacks to students’ work, explains the answers of classwork and gives additional illustrations for elaborating specific content if necessary. |
| After class | <ul style="list-style-type: none"> • Teacher posts comprehensive exercises and additional resources to students using the learning management system. • Students complete comprehensive exercises. • Teacher evaluates the comprehensive exercises. |

If the topic “selection statements” is delivered using the traditional teaching method, students, especially weaker students, may have difficulties to understand at the first encounter of the topic in class. Less lesson time is available for students to ask questions, discuss, practise and get feedbacks from teacher. Through the flipped learning approach, students should have some understanding of the topic before class since students should have watched videos, read materials, run sample code using visualizer and attempted pre-study exercise on the web. More lesson time can be spent in detailed explanation of difficult parts or classroom discussions to address students’ queries. Hence, flipped learning can help students to learn better and deeper.

Selected topics for flipped-classrooms

The senior secondary ICT curriculum consists of compulsory part and elective part. Each part consists of modules. A module covers several topics which are described by learning outcomes and contents. Topics will be selected from the compulsory part and the elective modules: Databases, Data Communications and Networking, Multimedia Production and Web Site Development, and Software Development. Learning and teaching materials consisting of notes (such as slideshow presentations), video clips/ visualizations/ simulations/ animations, pre-study exercises, worksheets for classroom activities and answers will be produced. According to the Information and Communication Technology Curriculum and Assessment Guide (Secondary 4-6) (CDC & HKEAA, 2015), schools can vary the sequence of the delivery of topics of the Senior Secondary ICT Curriculum according to the learning needs of students. For example, some schools may start the delivery of the options immediately after the related core module is covered. The duration of video clips of each mini-lecture is about 5 – 10 minutes. Tentatively, the following topics are selected as follows:

| Topic | Type of media (Number of Media) |
|---|---------------------------------|
| Compulsory Part | |
| <i>(A) Information Processing</i> | |
| (a) Introduction to Information Processing | Videos (3), Animations (2) |
| <i>(b) Data Organization and Data Control</i> | |
| Identify data, records, fields, files and databases. | Video (1) |
| Explain how records can be organized, stored and retrieved. | Video (1) |
| Discuss the need of data control. | Video (1) |
| Describe how errors can be detected | Video (1) |
| <i>(c) Data Representation</i> | |
| Distinguish between analog and digital data. | Video (1) |
| Convert integers from denary numbers to binary numbers or hexadecimal numbers, or vice versa. | Video (1) |
| Perform simple calculations on binary numbers and analyse overflow errors | Video (1) |
| Know how characters are represented by using common international standards. | Video (1) |
| Know briefly how different multimedia elements are digitalized. | Video (1) |
| <i>(d) The Use of Office Automation Software</i> | |
| Design and create formatted documents or reports effectively and suitably using a word-processing tool | Videos (3) |
| Convert between various document / text / formats and justify their usage. | Video (1) |
| Describe and use basic features of spreadsheets to solve problems | Video (1) |
| Demonstrate data manipulation techniques in spreadsheets. | Video (1) |
| Apply spreadsheets as a data analysis tool by using a pivot table. | Video (1) |
| Apply the concepts of data organization to create and maintain simple database using a Database Management System tool. | Video (3) |
| Create and use a form for data entry. | Video (1) |
| Practise data extraction and manipulation by querying a database and create reports. | Video (1) |

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| Understand concepts of Object Linking and Embedding and its applications. | Video (1) |
| Use a software suite in an integrated and effective manner. | Video (1) |
| (e) Presentation of Information | Videos (2) |
| <i>(B) Computer System Fundamentals</i> | |
| (a) Basic Machine Organization | |
| Explain the functions of hardware within a computer system. | Video (1) |
| Explain the structure and functions of a CPU and its components. Fetch-decode-execute cycle and the roles of registers and buses. | Videos (4), Animations (2) |
| (b) System Software | Videos (2) |
| (c) Computer Systems | Videos (2) |
| <i>(C) Internet and Its Applications</i> | |
| (a) Networking and Internet Basics | |
| Define and compare LAN and WAN. | Video (1) |
| Discuss the common network Services. | Video (1) |
| Explain functions of the hardware required for a network. | Video (1) |
| Compare common methods for Internet access in terms of speed, cost, security and availability. | Video (1) |
| Concepts of IP, URL, DNS, HTTP and FTP | Video (1) |
| (b) Internet Services and Applications | |
| Apply various services such as file transfer, remote logon, online chat, discussion forum and email on the Internet. | Video (1) |
| Describe the concepts of streaming technology and its applications. | Video (1) |
| Introducing web authoring tool | Video (1) |
| Design and construct web pages | Videos (2), Visualization (1) |
| <i>(D) Basic Programming Concepts</i> | |
| (a) Problem-Solving Procedures | |
| Videos (4) | |
| (b) Algorithm Design | |
| Define algorithm. Use pseudocode and program flowchart as methods for representing algorithm. | Videos (4) |
| Select appropriate data types for the solution to a particular problem and discuss the merit of the chosen types | Video (1) |
| Design and construct standard algorithms involving basic control structures. Create and examine algorithms. | Videos (5), Visualization (3) |
| Trace and test algorithms. | Videos (3), Visualization (3) |
| Elective Part (A) – Databases | |
| <i>(b) Relational Databases</i> | |
| Create a simple relational databases with SQL Create a simple relational database table with SQL: Table with columns only including constraints of “not null value”, “default value”, “unique value”, “primary key”, “foreign key” | Videos (7) |
| Modify the structures of the tables with SQL: Change the definition of a field, Change the name of a field, Adding a field, Removing a field | Video (1) |
| Removing a table and a database with SQL | Video (1) |
| Inserting data into a table with SQL: Insert data in all fields, Insert data in some fields | Videos (2) |
| Data queries with SELECT statements: Simple queries with SELECT statements, Queries with the WHERE clause, Queries with the WHERE clause using operators and expressions such as arithmetic operators and expressions, comparison operators, logical operators and the IN, between and like operators | Videos (8) |
| Built-in functions such as aggregate and string functions | Videos (2) |

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| Queries with the ORDER BY clause | Videos (2) |
| Queries with the GROUP BY clause | Video (1) |
| Queries with the HAVING clause | Video (1) |
| Modify data in the table | Video (1) |
| Delete data from the table | Video (1) |
| Create view | Video (1) |
| Queries on multiple tables, including Equi-join, Natural-join and Outer join | Videos (4) |
| Sub-queries (for one sub-level only) | Video (1) |
| Export query results to text, HTML or spreadsheet format | Videos (3) |
| <i>(c) Introduction to Database Design Methodology</i> | |
| Analyse simple scenarios in business, education or other fields and create simple ER diagrams with binary relationships | Videos/Animation (6) |
| Transform the ER diagrams to tables in relational databases | Videos (2) |
| Elective Part (B) – Data Communications and Networking | |
| <i>(a) Data Communications and Networking</i> | |
| Communications model and data encoding | Videos (4) |
| Network components | Videos (4) |
| TCP/IP Protocol Suites | Videos (8) |
| Basic concepts of data transmission | Videos (4) |
| Need analysis | Videos (2) |
| Network design | Videos (8) |
| Network set-up | Videos (3) |
| <i>(c) Network Management and Security</i> | |
| Network management | Videos (7) |
| Network security | Videos (7) |
| Elective Part (C) – Multimedia Production and Web Site Development | |
| <i>(a) Multimedia Production</i> | |
| <i>(ii) Multimedia Basic and (iii) Multimedia Products</i> | |
| Texts – attributes (e.g. font size and typeface) and Conversions | Video (1) |
| Bitmap and Vector Graphics – Attributes (e.g. colour depth and resolution), Capturing, Simple Editing and Conversions | Video (1) |
| Audio – attributes (e.g. bit rate and frequency), Capturing, Simple Editing and Conversions | Video (1) |
| Video – Attributes (e.g. frame rate and frame size), Capturing, Simple Editing, Mixing and Conversions | Video (1) |
| Animation – creating and editing | Video (1) |
| <i>(b) Web Site Development</i> | |
| <i>(ii) Web Authoring Tools</i> | |
| Construct simple web pages with different features: links, anchors, tables, frames, Mailto, fill-out forms, multimedia elements. | Videos (6), Visualization (6) |
| Perform special effect. | Video (1), Visualization (1) |
| Publish website. | Video (1) |
| <i>(iii) Dynamic and Interactive Web Pages</i> | |
| Create simple JavaScript program with variables, simple calculations. | Video (1), Visualization (1) |
| Use JavaScript functions embedded in HTML. | Video (1), Visualization (1) |
| Selection statements in JavaScript (if...else and switch...case). | Video (1), Visualization (2) |
| Iteration statements in JavaScript (for, while and do...while). | Video (1), Visualization (3) |
| Event Handling in JavaScript (onLoad, onClick, onMouseOver and etc.). | Video (1), Visualization (3) |
| Build interactive user selection using web authoring tool. | Video (1), Visualization (1) |
| Build 2-Level interdependent selection list in JavaScript. | Video (1), Visualization (1) |
| Basic input validation | Video (1), Visualization (1) |

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| Build a simple math quiz using JavaScript. | Video (1), Visualization (1) |
| Use of cookies for saving and retrieving user data. | Video (1), Visualization (1) |
| Elective Part (D) - Software Development | |
| Basic statements and operations variable and data types. | Video (1), Visualization (2) |
| Selection statements (If blocks, logical operators, nested If blocks, and case) | Video (1), Visualization (2) |
| Apply iteration Statements (for loop, repeat loop, while loop) | Visualization (3) |
| Procedures and functions (structured programming, procedures, global and local variables, recursion, function call) | Visualization (4) |
| Arrays (type of arrays, array techniques, two-dimensional Arrays) | Visualization (3) |
| Searching (linear search, binary search) | Visualization (2) |
| Sorting and merging (sorting, bubble Sort, insertion sort, merge sort, quick sort) | Visualization (5) |
| Stacks, queues, and linked lists | Visualization (2) |
| Object-oriented Programming (class, object, relationship between them) | Visualization (3) |
| Concepts of system development (the Waterfall model, prototype approach, rapid application development (RAD) approach) | Videos (3) |

5. Implementation Plan with Timeline

| Period | Milestone |
|---------------|--|
| 01 – 02 /2018 | <ul style="list-style-type: none"> • Formation of Community of Practice • Teacher development activities (TDA) for startup of Flipped Learning (FL) approach • Selection of topics of Flipped Learning and divided the topics into three sets for development in different stages • Staff recruitment • Procurement of equipment |
| 03 – 04/2018 | <ul style="list-style-type: none"> • Development of learning and teaching materials (LTM) for the pilot set of topics with review by teachers • Teacher development activities on flipped learning and using the learning and teaching materials • The first public seminar • Development of website of the CoP |
| 05 – 06/2018 | <ul style="list-style-type: none"> • Conducting flipped learning on the pilot set of topics in secondary schools as pilot run • Tests for student on the pilot set of topics |
| 07 – 08/2018 | <ul style="list-style-type: none"> • Focus group interviews with teachers for reviewing the pilot set of learning and teaching materials • Development of learning and teaching materials for the 1st set of topics with review by teachers • Teacher development activities on flipped learning and using the learning and teaching materials • Improvement of learning and teaching materials for the pilot set of topics |
| 09 – 12/2018 | <ul style="list-style-type: none"> • Pre-tests for students on self-directed learning readiness • Conducting flipped learning on the 1st set of topics in secondary schools • Tests for student on the 1st set of topics • Development of learning and teaching materials for the 2nd set of topics with review by teachers • Teacher development activities on flipped learning and using the learning and teaching materials • Tests for students on self-directed learning readiness |

| | |
|-----------------|--|
| 01 – 06/2019 | <ul style="list-style-type: none"> • Conducting flipped learning on the 2nd set of topics in secondary schools • Focus group interviews with teachers for reviewing the 1st set of learning and teaching materials • Tests for students on self-directed learning readiness • Students' perception questionnaires • Tests for students on the 2nd set of topics • Improvement of learning and teaching materials for the 1st set of topics |
| 02-08/2019 | <ul style="list-style-type: none"> • Focus group interviews with teachers for reviewing the 2nd set of learning and teaching materials • Improvement of learning and teaching materials for the 2nd set of topics • Development of learning and teaching materials for the 3rd set of topics with review by teachers |
| 09 – 11/2019 | <ul style="list-style-type: none"> • Conducting flipped learning on the 3rd set of topics in secondary schools • Tests for students on the 3rd set of topics |
| 10 – 12/2019 | <ul style="list-style-type: none"> • Focus group interviews with teachers for reviewing all learning and teaching materials • Further improvement of learning and teaching materials of all topics • Teacher development activities • The second public seminar • Overall evaluation report • Completion of website of the CoP |

The Information Technology Discipline will collaborate with the CoP to organize teacher development activities. The details of the teacher development activities can be found in Appendix 3.

6. Teachers' and Principals' Involvement in the Project

The Information Technology Discipline will invite principals and teachers through formal membership in project steering committee and informal partnership arrangements. Inputs from principals and teachers will be sought on the following:

- Training activities on flipped learning
- Selection of topics for flipped learning
- Review of the developed learning materials and provide feedbacks for improvement
- Flipped learning using the developed learning materials for their students
- Regular meetings for sharing of experiences in flipped learning
- Focus group interviews

7. Budget

| Item | | 1 Jan 2018 – 31 Dec 2018 | 1 Jan 2019 – 31 Dec 2019 | Total |
|----------|--|-----------------------------|-----------------------------|--------------|
| A | Staff | | | |
| 1 | Term Lecturer x 1 (\$35780 x 24 months + 1500 x 24 (MPF)) | \$ 447,360 | \$ 447,360 | \$ 894,720 |
| 2 | Term Teaching Associate x 4 (\$27195 x 24 months x 1.05 (MPF) x 4) | \$ 1,370,628 | \$ 1,370,628 | \$ 2,741,256 |

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|----------|---|--------------|--------------|--------------|
| 3 | Part-time Executive Assistant II(s) for video capture, editing, production of learning media and support public seminars (\$84/hr x 2000 hrs x 1.05 (MPF)) | \$ 88,200 | \$ 88,200 | \$ 176,400 |
| | Subtotal | \$ 1,906,188 | \$ 1,906,188 | \$ 3,812,376 |
| B | Services | | | |
| 1 | Web hosting | \$ 84,000 | \$ 84,000 | \$ 168,000 |
| 2 | Domain name registration | \$ 150 | \$ 150 | \$ 300 |
| | Subtotal | \$ 84,150 | \$ 84,150 | \$ 168,300 |
| C | Equipment | | | |
| 1 | 5 sets of desktop computers | \$ 28,000 | \$ 0 | \$ 28,000 |
| 2 | Statistics (e.g. Base, Regression, Advanced Stat, Custom Tables, Data Preparation, Missing Values, Forecasting, Decision Trees, Direct Marketing, Complex Samples, Conjoint, Neural Networks, Bootstrapping, Categories, Exact Tests. Visualization Designer, and) x 2 licenses (for statistical analysis) | \$ 1,000 | \$ 1,000 | \$ 2000 |
| 3 | (All Apps) for Website Design and Video Editing x 2 | \$ 3,552 | \$ 3,552 | \$ 7104 |
| | Subtotal | \$ 32,552 | \$ 4,552 | \$ 37,104 |
| D | General Expenses | | | |
| 1 | Public seminars (handouts, materials, etc.) | \$ 6,039 | \$ 6,039 | \$ 12,078 |
| 2 | Teacher development activities (handouts, materials, etc.) | \$ 6,000 | \$ 6,000 | \$ 12,000 |
| 3 | Posters for promotion (\$10 x 1,000) | \$ 5,000 | \$ 5,000 | \$10,000.00 |
| 4 | Postages and envelopes (\$7 x 1,000) | \$ 3,500 | \$ 3,500 | \$ 7,000 |
| 5 | Auditor | \$ - | \$ 15,000 | \$ 15,000 |
| | Subtotal | \$ 20,500 | \$ 35,500 | \$ 56,078 |
| E | Others | | | |
| 1 | Contingency (~3% of the total project sum excluding staff costs) | \$ 4,116 | \$ 3726 | \$ 7,842 |
| | Subtotal | \$ 4,116 | \$ 3726 | \$ 7,842 |
| | Total | \$ 2,047,545 | \$ 2,034,155 | \$4,081,700 |

Budget Justifications

Staff costs

The senior secondary ICT curriculum covers a wide range of topics since the curriculum has four elective parts with 75 lesson hours each. The total lesson hours of all topics of the senior secondary ICT curriculum is 475 hours and is much higher than those of many senior secondary elective subjects, such as Physics (325 hours) and Economics (272 hours). The project involves the creation of a Community of Practice involving 20-40 schools and about 60 teachers, the development of brand-new interactive e-learning materials for flipped learning, organization of 10 teacher training activities, public seminars, survey of students' feedbacks and focus groups interviews at different stages of the project, and preparation of the evaluation report and various publicity activities. One term lecturer and four term teaching associates are required to complete the above tasks.

In addition, the development of the learning and teaching materials will be supported by experienced teachers of IVE. With support of the CoP, they will help to design and control the quality of the learning materials. The term lecturer and teaching associates will also help to act as substitute teachers for relieving some teaching load of the IVE teachers who will participate in the project. The learning contents will be developed by the term teaching associates and the term lecturer. The media production of learning materials from the learning contents involves tedious and time-consuming work, such as video capture, editing, animation effects, etc. A part-time Executive Assistant II needs to be hired to produce the media as well as assist the project team organizing the public seminars.

The term lecturer will act as the project leader, communicate with all stakeholders, coordinate all activities and prepare the evaluation report of the project. The term lecturer needs to have a degree in IT or equivalent and three years' relevant experience. The duties and responsibilities of the term lecturer are:

- To carry out administration and coordination duties of the project
- To assist the Principal Investigator on-going monitoring and evaluation of the project
- Acts as internal and external liaison person
- To assist in the preparation of the progress and final reports to the Quality Education Fund
- To organize teacher development activities, public forums, focus groups interviews, survey of students' feedbacks and collection of data for evaluation of the project
- To prepare the learning contents of selected topics in learning materials for selected topics in "Information Processing" and "Computer System Fundamentals" of senior secondary ICT curriculum
- To design the website of the Community of Practice
- To act as substitute teacher for relieving some teaching of IVE teachers who participate in the project

The term teaching associates needs to have a degree in IT or equivalent. The following are the responsibilities of the four term teaching associates:

| Term Teaching Associate | General Responsibilities | Specific Responsibilities |
|-------------------------|--|--|
| TA1 | <ul style="list-style-type: none"> • To assist the Project Leader to organize teacher development activities, public forums, focus groups interviews. | <ul style="list-style-type: none"> • Develop learning materials for selected topics in "Internet and its application" and the elective part "Databases" of senior secondary ICT curriculum • To assist the Project Leader to organize survey of students' feedbacks and collection of data for evaluation of the project |
| TA2 | <ul style="list-style-type: none"> • To produce the media of the learning contents | <ul style="list-style-type: none"> • To implement the website of the Community of Practice • Develop learning materials for selected topics in the elective |

| | | |
|-----|---|--|
| | with the assistance of the part-time Executive Assistant II | part "Multimedia Production and Web Site Development" of senior secondary ICT curriculum |
| TA3 | <ul style="list-style-type: none"> To act as substitute teacher for relieving some teaching of IVE teachers who participate in the project | <ul style="list-style-type: none"> Develop learning materials for selected topics in "Basic Programming Concepts" and the elective part "Software Development" of senior secondary ICT curriculum |
| TA4 | | <ul style="list-style-type: none"> Develop learning materials for selected topics in "The Networking and Internet Basics" and the elective part "Data Communications and Networking" of senior secondary ICT curriculum |

Services

There is a need to purchase services for web hosting of the proposed Community of Practice (CoP). The website is a repository for dissemination of the learning materials, teacher development activities and latest events of the CoP. Since the learning materials contains many high quality videos, it is required that the web hosting service provides high and stable download bandwidth for handling peak network traffic from teachers. Therefore, more budget is needed for web hosting service of the learning materials.

Equipment

Software licenses are needed for statistical analysis of the data collected from questionnaires and test results of students, media production (video capture and editing).

General Expenses

The general expenses include the costs for the posters, materials, handouts, travel expenses of the public seminars, teaching development activities and auditor fee.

8. Expected Deliverables and Outcomes

The main deliverables of the project include:

- A Community of Practice of Flipped Learning for ICT teachers for sharing of good practices and promotion of flipped learning. The detailed description of the CoP can be found in Appendix 7.
- 11 teacher development activities, including two rounds of public seminars, for promoting flipped learning and the use of the developed e-learning materials; two rounds of public seminars targeting for school leaders and teachers to enable them to understand how to implement flipped learning on the senior secondary ICT curriculum
- E-learning materials for flipped learning on the selected topics of the senior secondary ICT curriculum
- A teacher's guide to using the e-learning materials
- A website of e-learning materials to promote flipped learning, teachers development activities and the developed learning and teaching materials
- An evaluation report on the effectiveness of flipped learning on senior secondary ICT curriculum

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9. Project Evaluation

Perception surveys and interviews

, in a self-report questionnaire , will be developed and used to measure students' self-directed learning readiness in the areas of self-management, desire for learning and self-control at the beginning and the end of the first term, and the end of the second term of AY 2018/19.

Students' self-directed learning readiness scores at the beginning of the first term, the end of the first term and the end of the second term of AY 2018/19 will be compared.

At the end of the second term of AY 2018/19, students and teachers will complete questionnaires and interviews on how they feel about the effectiveness of flipped learning.

Test scores on selected topics of flipped learning

Tests will be conducted to measure the performance of students in the selected topics through flipped learning. The test results will be used to evaluate the effectiveness of flipped learning.

Success Criteria

The following are the success criteria of the project:

- The expected deliverables and outcomes are achieved.
- More than half of the questionnaire responses of students have indicated that flipped learning has helped their learning.
- More than half of the questionnaire responses of teachers have indicated that flipped learning can help students' learning.

10. Sustainability of Project Outcomes

The outcomes of the project provide insight for the following parties, which can sustain the project impact after the completion of the project:

For schools

The school leaders of the participating schools and other schools will be invited to participate in the public seminars. Teachers will be invited to share their good practices of flipped learning in the public seminars. With understanding of flipped learning, the school leaders can continue to fine-tuning and improvement of policy and implementation strategies of flipped learning at the school level.

For teachers

The teacher development activities, teacher's guide to using the e-learning materials and the developed e-learning materials can provide teachers a quick and easier way to start flipped learning of the senior secondary ICT curriculum. The Community of Practice will continue to promote and support flipped learning in secondary schools. After the completion of the project, the Information Technology Discipline will provide the free web hosting service of the learning materials for download by teachers. The IT Discipline will provide free services of the management of school accounts of the website of the learning materials.

11. Dissemination/Promotion of Project Outcomes

The Information Technology Discipline has very extensive and close relationships with secondary schools. The project team will partner with [redacted] and secondary schools to disseminate the findings using the developed e-learning materials for flipped learning through teacher development activities, public seminars, the website of the project, the evaluation report, press release and academic publications targeting different stakeholder groups.

Part D Details of Collaborating / Participating Organisations

[redacted] is the collaborating organization of the project. [redacted] will collaborate with the applicant with the following roles:

- provide advices to the project team on various matters, such as topics of flipped learning, teacher development activities, etc.
- review the deliverables of the project
- co-organize the teaching development activities and public seminars
- manage the Community of Practice and liaise with schools involved

The following schools have committed to participating in the project (confirmations of participation from schools can be found in Appendix 6):

| | Name of School | | Name of School |
|----|---|----|--|
| 1 | CCC Kei Chi Secondary School | 18 | The Chinese Foundation Secondary School |
| 2 | The Hong Kong Management Association K S Lo College | 19 | Heung To Middle School (Tin Shui Wai) |
| 3 | Hoi Ping Chamber of Commerce Secondary School | 20 | Hong Kong True Light College |
| 4 | The Church of Christ in China Kwei Wah Shan College | 21 | Ying Wa College |
| 5 | King Ling College | 22 | St. Joseph's College |
| 6 | San Wui Commercial Society Secondary School | 23 | The Hong Kong Baptist University Affiliated School Wong Kam Fai Secondary School |
| 7 | Yan Chai Hospital No.2 Secondary School | 24 | Baptist Lui Ming Choi Secondary School |
| 8 | Rhenish Church Pang Hok Ko Memorial College | 25 | Maryknoll Fathers' School |
| 9 | Lee Kau Yan Memorial School | 26 | St Stephen's College |
| 10 | Sha Tin Methodist College | 27 | TWGHs Lui Yun Choy Memorial College |
| 11 | FDBWA Szeto Ho Secondary School | 28 | Lock Tao Secondary School |
| 12 | PLK Yao Ling Sun College | 29 | C&MA Sun Kei Secondary School |
| 13 | Lingnan Hang Yee Memorial Secondary School | 30 | HKCCCU Logos Academy |
| 14 | SKH Leung Kwai Yee Secondary School | 31 | Yan Chai Hospital Law Chan Chor Si College |
| 15 | Leung Sing Tak College | 32 | Jockey Club Ti-I College |
| 16 | SKH Bishop Mok Sau Tseng Secondary School | 33 | Immaculate Heart of Mary College |
| 17 | SHK St. Mary's Church Mok Hing Yiu College | | |

Assets Usage Plan

| Category (in alphabetical order) | Item / Description | No. of Units | Total Cost | Proposed Plan for Deployment <i>(Note)</i> |
|-------------------------------------|----------------------------|-----------------|------------|---|
| computer hardware | set of desktop computer | 5 | \$ 28,000 | Support the free web hosting service of the learning materials for download by teachers and free services of the management of school accounts of the website of the learning materials |

Report Submission Schedule

The Information Technology Discipline commits to submit proper reports in strict accordance with the following schedule:

| Project Management | | Financial Management | |
|--|-----------------|---|-----------------|
| Type of Report and covering period | Report due date | Type of Report and covering period | Report due date |
| Progress Report 01/01/2018 - 30/06/2018 | 31/07/2018 | Interim Financial Report 01/01/2018 - 30/06/2018 | 31/07/2018 |
| Progress Report 01/07/2018 - 31/12/2018 | 31/01/2019 | Interim Financial Report 01/07/2018 - 31/12/2018 | 31/01/2019 |
| Progress Report 01/01/2019 - 30/06/2019 | 31/07/2019 | Interim Financial Report 01/01/2019 - 30/06/2019 | 31/07/2019 |
| Final Report 01/01/2018 - 31/12/2019 | 31/03/2020 | Final Financial Report 01/01/2018 - 31/12/2019 | 31/03/2020 |

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Appendix 1– Project Team

| Name of Member/ Role | Affiliation and Responsibilities |
|---------------------------------------|----------------------------------|
| <p>Dr. [Name]</p> <p>[Faded text]</p> | <p>[Faded text]</p> |
| <p>[Faded text]</p> | <p>[Faded text]</p> |
| <p>[Faded text]</p> | <p>[Faded text]</p> |



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Appendix 2– Biographies of Project Team Members

[The content of this page is extremely faint and illegible. It appears to contain several paragraphs of text, likely biographies of project team members, but the text cannot be transcribed accurately.]

Appendix 3 – Teacher Development Activities

| Date | Activity (duration) | Topics/Content | Speaker(s) |
|---------|---|---|--|
| 02/2018 | Flipped learning training for representatives of secondary school teachers in development teams of learning materials (3 hours) | <ul style="list-style-type: none"> The flipped learning model and process Comparison between traditional teaching method and flipped learning Design of learning activities and materials for flipped learning Evaluation and improvement process of learning materials | <ul style="list-style-type: none"> Expert from Centre of Learning and Teaching (VTC) ICT secondary teacher who has practiced flipped learning |
| 04/2018 | Seminar on Flipped Learning in Senior Secondary ICT Curriculum (First Public Seminar) (3 hours) | <ul style="list-style-type: none"> Successful stories of flipped learning The flipped learning model and process Comparison between flipped learning and traditional teaching method The advantages of flipped learning Tips and tricks of flipped learning Experience sharing by ICT secondary teachers Aims and objectives of the CoP Questions and answers | <ul style="list-style-type: none"> Expert in flipped learning from an institute of Tertiary Education ICT secondary teachers who have practiced flipped learning Project team members |
| 04/2018 | 4 teacher development sessions for use of learning materials (one training session for materials for each elective part and compulsory part) (3 hours each, total 12 hours) | <ul style="list-style-type: none"> Brief introduction of flipped learning The content of the pilot set of learning materials How to use the pilot set of learning materials Tips and tricks Questions and answers | Project team members |
| 7/2018 | 4 teacher development sessions for reviewing learning materials (3 hours each, total 12 hours) | <ul style="list-style-type: none"> Sharing of experience of representatives of ICT teachers Feedbacks from ICT teachers on flipped learning and the learning materials for the pilot set of topics Suggestions of improvements of learning materials | <ul style="list-style-type: none"> Representatives of teachers Project team members |
| 8/2018 | 4 teacher development sessions for use of learning materials (3 hours each, total 12 hours) | <ul style="list-style-type: none"> The content of the 1st set of learning materials How to use the 1st set of learning materials Tips and tricks Questions and answers | Project team members |
| 12/2018 | 4 teacher development sessions for use of learning materials (3 hours each, total 12 hours) | <ul style="list-style-type: none"> The content of the 2nd set of learning materials How to use the 2nd set of learning materials Tips and tricks Questions and answers | Project team members |

| | | | |
|---------|--|--|--|
| 1/2019 | 4 teacher development sessions for reviewing learning materials (3 hours each, total 12 hours) | <ul style="list-style-type: none"> • Sharing of experience of representatives of ICT teachers • Feedbacks from ICT teachers on flipped learning and the learning materials for 1st set of topics • Suggestions of improvements of learning materials | <ul style="list-style-type: none"> • Representatives of teachers • Project team members |
| 7/2019 | 4 teacher development sessions for reviewing learning materials (3 hours each, total 12 hours) | <ul style="list-style-type: none"> • Sharing of experience of representatives of ICT teachers • Feedbacks from ICT teachers on flipped learning and the learning materials for the 2nd set of topics • Suggestions of improvements of learning materials | <ul style="list-style-type: none"> • Representatives of teachers • Project team members |
| 12/2019 | 4 teacher development sessions for reviewing learning materials (3 hours each, 12 hours) | <ul style="list-style-type: none"> • Sharing of experience of representatives of ICT teachers • Feedbacks from ICT teachers on all learning materials • Suggestions of improvements of all learning materials | <ul style="list-style-type: none"> • Representatives of teachers • Project team members |
| 12/2019 | Seminar on Flipped Learning in Senior Secondary ICT Curriculum (Second Public Seminar) (3 hours) | <ul style="list-style-type: none"> • Successful stories of flipped learning • The flipped learning model and process • Comparison between flipped learning and traditional teaching method • The advantages of flipped learning • Tips and tricks of flipped learning • Experience sharing by ICT secondary teachers • Aims and objectives the CoP • Learning materials of the website of the COP • Questions and answers | <ul style="list-style-type: none"> • ICT secondary teachers who have practiced flipped learning • Project team members |
| 12/2019 | 4 teacher development sessions for use of learning materials (3 hours each, total 12 hours) | <ul style="list-style-type: none"> • The content of all learning materials for Compulsory Part and Elective Part • How to use the learning materials • Tips and tricks • Questions and answers | Project team members |

Appendix 4 – Visualization of program execution and animation and tracing of algorithm

The screenshot shows the Python Tutor interface for a Java program. The code is as follows:

```

1 public class NestedLoop {
2     public static void main(String[] args){
3         for (int i=1; i < 10; i++){
4             for (int j=1; j < i; j++){
5                 System.out.println("i = " + i + ", j = " + j);
6             }
7     }
8 }

```

The execution is at Step 11 of 148. The current state is:

- main:4
 - i | 2
 - j | 1

The program output is: i = 2, j = 1

Figure 1: Visualization of the execution of a nested for-loop using free open-source program visualization tool, Python Tutor (www.pythontutor.com/).

The screenshot shows the Python Tutor interface for a Java program. The code is as follows:

```

1 public class MaxNumber {
2
3     public static void main(String[] args) {
4         int x = 11;
5         int y = 6;
6         int max = maxFunction(x, y);
7         System.out.println("Maximum Value = " + max);
8     }
9
10    /** returns the maximum of two numbers */
11    public static int maxFunction(int n1, int n2) {
12        int max;
13        if (n1 > n2)
14            max = n1;
15        else
16            max = n2;
17
18        return max;
19    }
20 }

```

The execution is at Step 8 of 13. The current state is:

- main:6
 - x | 11
 - y | 6
- maxFunction:14
 - n1 | 11
 - n2 | 6
 - max | 11

The program output is empty.

Figure 2: Visualization of the execution of a program with function call using Python Tutor.

**Appendix 5 – Brief Curriculum Vitae
of
Project Team Members**

Appendix 6 –

Confirmation

of

Participation from Secondary Schools

| | |
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Appendix 7 –

Community of Practice (CoP) of Flipped Learning for ICT Teachers

The Community of Practice of Flipped Learning for ICT Teachers will be managed by Association of IT Leaders in Education as a sub-committee of the association.

Objectives:

- To promote student-centered learning for the development of domain knowledge
- To encourage teachers and students to adopt active and interactive learning pedagogy
- To promote sharing of the experience in flipped learning

Members:

- ICT teachers of secondary schools

Executive Members:

- Chairman
- Secretary
- Members from Secondary Schools
- Representative from IT Discipline

Plan of Activities:

The CoP will co-organize the teacher training activities in Appendix 3. After the project completion, the CoP will continue to organize sharing sessions / seminars / workshops for the flipped learning in ICT curriculum.

