

Department of Computer Science
University of Hong Kong

Final Year Project 2017/18
Project Plan

STEM Toolkit with Microbit

Au Ching Mei
(3035123227)

Supervised by Dr. Lau Vincent

Table of Content

1. Introduction	2
2. Project Overview	3
2.1. Objectives	3
2.2. Background	3
2.3. Scope	3
2.4. Deliverables	3
2.5. Prerequisites	4
3. Approach	4
3.1. Teaching	4
3.2. Website Design	4
3.3. Textbook Design	5
4. Project Management	5
4.1. Feasibility	5
4.2. Challenge	5
4.3. Schedule	6
5. References	7

1. Introduction

STEM is an acronym stands for Science, Technology, Engineering and Mathematics. In the information era, STEM related products and projects are everywhere in daily life that uplift the living quality of people, such as fan, phone and traffic system. IT is essential to facilitate the launch of these sophisticated projects. Since the success in STEM can improve the economy and livelihood of the country, the demand of related experts increases for the sake of the development of the society.

Many countries have raised interests in this field of education in recent years, such as the United States promotes STEM education and gives many resources to schools in conducting education with STEM. On 25 Sep 2017, White House announced a 200 million dollars per year commitment to high quality STEM and computer science education[1]. The Education Bureau also encourages STEM education in Hong Kong and introduces it to local primary and secondary schools starting from 2016[2].

The goal of STEM education is to equip the youths to solve difficult problems, with the integration of the knowledge and skills, which is beyond the traditional school education. The issue is how to achieve that goal.

In Hong Kong, the fields of science, technology and mathematics are included in the curriculum. This paper proposes the key to achieve the goal are engineering and coding. Engineering emphasize on the process to produce the concrete solution and a bridge for learners to link up and apply the knowledge of other disciplines. Coding is the skill required to instruct the computer to perform tasks. Therefore, project-based learning with coding is the main idea in the project.

This project is to develop a toolkit that introduce STEM with Microbit from scratch for children aged from 8 to 13 in Hong Kong. The toolkit includes printed and electronic learning materials.

The remainder of this paper is going to explain the project details and discuss how to achieve the objectives first. Then, the paper will study the approach in teaching and designing toolkit, and lastly, how to implement and manage the project.

2. Project Overview

This section is going to show what the toolkit in the project is about.

2.1. Objectives

The project aims to raise learner's interest in studying STEM-related disciplines and introduce coding with linkage to daily life.

2.2. Background

STEM education is popular topic and there are abundant related resources on the internet. The official website of Microbit, microbit.org has many resources for teachers to teach computer science with Microbit projects. The biggest and successful learning platform for coding, code.org, has interesting and interactive tutorials in learning basic programming concepts.

As mentioned in the introduction, project-base learning is the main approach to teaching in this project. In Hong Kong, traditional STEM related projects in schools are mostly science projects like paper aeroplane, water rocket, aquaponics. These projects are well designed to consolidate student's knowledge but they barely have IT element.

In order to introduce coding in STEM, a tiny programmable computer called Microbit is used in the project. Microbit is designed by the BBC for the use in computer education in the UK and to encourage children to explore and create new things. Therefore, learners can build their own STEM projects alone at home.

2.3. Scope

In this project, an interesting STEM toolkit with Microbit is proposed for children aged from 8 to 13 in Hong Kong. The toolkit includes some basic STEM related disciplines and computer knowledge, tutorials on Microbit, and a few guided STEM projects with Microbit. However, there will be no resources specifically for teachers in the toolkit. It provides self-learning materials for the learner only. In addition, English is the language used in the whole toolkit.

2.4. Deliverables

There will be a printed textbook and an interactive learning website. Both textbook and website provide knowledge, tutorials and exercises. But the website will be the main focus in this project. This electronic content features on interactive learning elements. Aside from easily

access, website can use multimedia in teaching and make learning more interesting.

2.5. Prerequisites

Users of the toolkit are expected to have a Microbit to work with throughout the whole learning process.

3. Approach

This section discuss the teaching approach to STEM education will be used in this project, and illustrate the design of website and textbook of the toolkit individually in details.

3.1. Teaching

The whole learning materials is basically built from Microbit tutorials and its STEM projects. There are lessons in the flow of these Microbit activities. Each lesson holds one fundamental learning keypoint of STEM-related disciplines or computer science. With the learning keypoint, the lesson introduce the concept first, then give one or two daily examples and explain, and finally lead to the realisation of the idea on Microbit.

All STEM projects are problem driven. Learners are motivated to design the solution to the real life problems. There will be guidance to let learners use the engineering approach in solving problems in the projects.

3.2. Website Design

In order to make the toolkit attractive to young learners and let them be engaged in learning, the website will use multimedia like graphics, videos and animation in the content. Since the target users of the website are the youths, the visual element and style should be well-adjusted, such as larger font size, lively font and color.

The major feature of the website is the interactive exercises. Apart from question type of exercise, activities like drag and drop, mini game, simulation, and more will be introduced to the website.

3.3. Textbook Design

Considering that it is a self-learning toolkit, the textbook needs not to be only plain and dull design. The printed materials is expected to be interesting and attractive to young readers, so the main tone can be a little bit casual and the design style can be more cheerful. There will also be some storylines and cartoons in the textbook to between sections and hence increase the readability.

4. Project Management

This section is going to discuss how to make the project and plan work by propose mechanisms to evaluate the feasibility of the project, identify foreseeable challenge and discuss plans to handle it, and suggest the schedule and budget for this project to follow.

4.1. Feasibility

So as to evaluate the product to ensure it is feasible, user acceptance test will be conducted. There will be 10 users in the test and feedbacks will be collected to see if the product satisfy the project objectives. With the feedbacks, adjustments will be made immediately or scheduled to perform rank by the urgency and complexity of the problem.

On the other hand, there will be a technical test on the website to make sure it is robust and available to users.

4.2. Challenge

The teaching aspect is the greatest challenge since STEM education is a new thing and education requires experience. Therefore, more research on this area is expected.

4.3. Schedule

Figure 1 below shows the project schedule. The project starts from September 2017 and ends at May 2018. There are 4 stages in the project. Stage 1 is planning and designing; stage 2 is implementation; stage 3 is testing, evaluation and modification; stage 4 is finalizing everything.

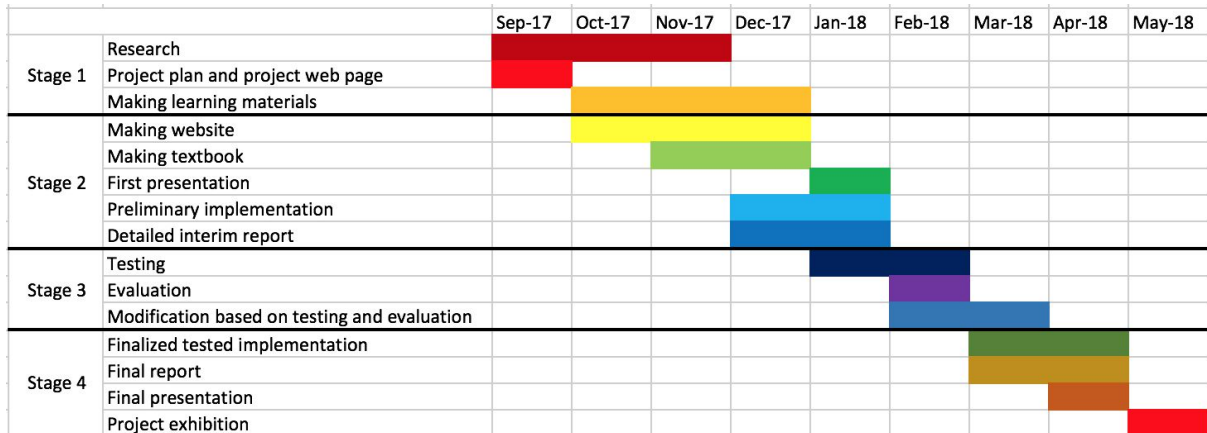


Figure 1. Gantt chart of project schedule

5. References

[1] White House. (2017, Sep 25). *Expanding Access to High Quality STEM and Computer Science Education Provides More Pathways to Good Jobs* [Online]. Available:

<https://www.whitehouse.gov/the-press-office/2017/09/25/expanding-access-high-quality-stem-and-computer-science-education> [Accessed: 2017, Sep 29]

[2] Education Bureau. (December 2016). *Report on Promotion of STEM Education* [Online]. Available:

http://www.edb.gov.hk/attachment/en/curriculum-development/renewal/STEM%20Education%20Report_Eng.pdf [Accessed: 2017, Sep 15]