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FACILITATION OF INTRINSIC MOTIVATION IN COURSE PROJECT WORK

Abstract:

In the society with highly developed and successful economy, students tend to lack motivation in mastering knowledge and skills when they are guaranteed a good life in the future. Polytechnics in Singapore were set up with the mission to train professionals to support the technological and economic development of Singapore. Intrinsic motivation (IM) is tapped in the project work of a 3rd year module ET0706 Object Oriented Programming (OOP, in Java) in DCPE (Diploma of Computer Engineering) at the School of Electrical and Electronic Engineering, Singapore Polytechnic. Performance approach goals were set for the students who are high in achievement orientation; while mastery approach goals were set for the students low in achievement orientation. In this paper, it is presented how RAMP (Relatedness, Autonomy, Mastery and Purpose) of IM elements are implemented into the module project work to motivate students high in achievement orientation to acquire advanced knowledge and apply it in challenging real-life projects, such as those involved in serving the community; in the meantime, motivate students low in achievement orientation to focus on foundation knowledge through applying it in solving real-life problem with adequate challenge. It is concluded that it is effective to apply IM to motivate students and get them to be work ready, future ready and world ready.

Keywords:

Intrinsic Motivation, Computer Engineering, Peer Tutoring, Real-life Project, Performance Approach, Mastery Approach

JEL Classification: I20, I23, I29

1. Introduction

Polytechnics in Singapore were set up with the mission to train professionals to support the technological and economic development of Singapore (Ministry of Education, Singapore, 2014). The education provided in polytechnics places strong emphasis on practice-based learning which is directly relevant to the students' future careers. Singapore has a highly developed and successful economy (AsianInfo.org, 2010) . Due to the fact that a comfortable life seems “guaranteed”, some students tend to lack motivation to study hard and master technical skills. Today’s students are tomorrow’s main workforce of the country’s economy. Are all students motivated enough to pursue and achieve academic goals on their own and ready for their future jobs? How can schools ensure that all students, regardless of their social, economic, and intellectual statuses, learn and become useful and productive members of society?

Singapore Polytechnic strives to be a future-ready institution that prepares our learners to be life ready, work ready and world ready. The purpose of this teaching practice is to introduce how IM is tapped in a 3rd year module project work of DCPE course in School of EEE, Singapore Polytechnic to motivate students in developing solutions for real-life problems.

2. Intrinsic Motivation

Motivation is defined as the level of effort an individual is willing to expend to achieve a certain goal. Motivation is also typically defined as the forces that account for the arousal, selection, direction, and continuation of behavior (Biehler and Snowman, 1993).

There are four kinds of motivation (Alexander Kjerulf, 2006) as illustrated in Fig 1.

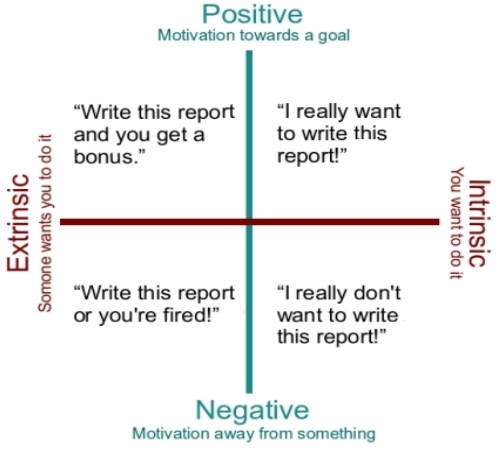

Fig.1 Four kinds of motivation

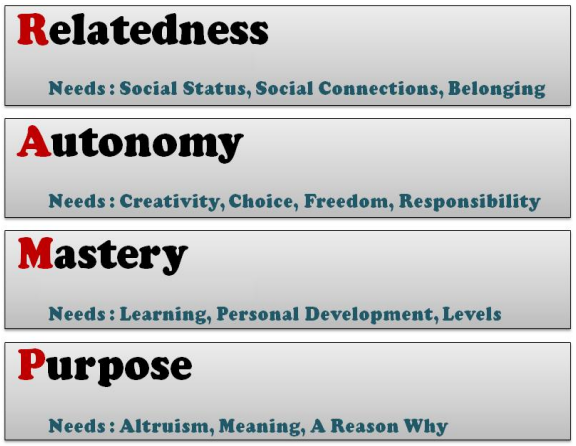

Fig.2 The Intrinsic Motivation RAMP

Intrinsic motivation is defined as the doing of an activity for its inherent satisfactions rather than for some separable consequence. Various studies show that intrinsic motivation results in high-quality learning and creativity (Richard M. Ryan, Edward L. Deci., 1999). It has emerged as an important phenomenon for educators. Its definition implies that motivation comes from within a person. Schools’ responsibility is to provide the conditions that will enhance students’ motivation to pursue academic goals actively over a long period of time.

To be better equipped with the IM facilitation skills, a group of lecturers from School of EEE attended the IM workshop conducted by Department of Educational Development (EDU), Singapore Polytechnic. The acronym RAMP as illustrated in Fig. 2 (Andrzej Marczewski, 2013) was used to help lecturers to share common language regarding IM among teaching staff.

Below is a brief explanation of how RAMP works.

Relatedness refers to the desire to connect with others and to experience a sense of belonging in a social context. Need is fulfilled when:

- Students authentically (socially and emotionally) connect with others.
- Students feel involved in the social context.

Autonomy refers to freedom to direct our own lives. Need is fulfilled when students have autonomy over:

- Task (what they do)
- Time (when they do it)
- Technique (how they do it)
- Team (who they do it with)

Mastery or competence refers to the desire to get better at something that matters. Need is fulfilled when:

- Students feel effective in interacting with the social environment through engagement, effort and deliberate practice
- Students achieve desired outcomes

Purpose refers to the yearning to do what we do in the service of something larger than ourselves. Need is fulfilled when:

- Students develop an appreciation of learning as having value in larger context
- Students desire to live a life of purpose can predict high performance

3. About the module

The ET0706 is a 3rd year DCPE semester based core module, in which Java programming is taught. There are a 2-hour lecture and a 3-hour practical session every week. It has 5 assessment components as shown in Table 1.

Table 1. ET0706 Module Assessment

Assessment Component	Weightage
General Performance	10%
Lab Test 1(in week 7)	10%
Lab Test 2(in week 11/12*)	15%
Quizzes (in week 7 and 15*)	20%
Project (from week 12/13* to 15*)	40%

During the first 12/13 weeks, new contents are taught during the lecture session. Students are required to complete programming exercises related to the weekly lecture topics in the practical session. Two Lab Tests are conducted to assess the students' understanding of the module content and programming skill.

The purpose of the ET0706 module project is to reinforce what students have learnt and for them to apply it to solve real-life problems.

A module project is introduced to students during the first half of the semester. It is an open concept project where each student needs to prepare a concept paper to identify a real-life problem and craft out a solution to it with a flowchart and Graphic User Interface (GUI) sketched. Students are encouraged to solve problems related to a particular community. Suggested communities are the energy sector where problem statements were proposed by industries, government sector where creative ideas from public were called to address issues in various areas using government data, etc. However students are also free to identify any

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*All the 3rd year lessons are cancelled due to Final Year Project Exhibition on the first week of term 2 or term 4. Here, by week we mean teaching week, where break and MST week are not counted.

other problems arising from different communities, such as the underprivileged.

Although the module knowledge obtained in the first half of semester is insufficient for them to design a solution to a real-life problem, students can start to observe what problem

people are facing, think about a solution to it and discuss with lecturers, classmates and even end users. They will pay more attention to future knowledge required to complete their project. Stronger students can start to pick up relevant knowledge in advance by themselves.

The concept paper is to be submitted to the practical lecturer one week before Lab Test 2, when 90% of the content has been taught. Lecturers will discuss with and provide constructive feedback to every student on his concept paper in the following aspects:

- Does the project help to solve a real-life problem?
- Is the solution user-friendly?
- Does the project meet the module minimum standard?
- Does the level of difficulty of the project match the student's capability?

Students have a week's time to fine-tune their concept paper according to the lecturers' feedback and resubmit it by the end of Lab Test 2 week.

With the concept paper fine-tuned after Lab Test 2, students have defined the problem, determined the project requirements and conceived the solution by then. Now, students have 3-4 weeks' time to implement their solution to the problem with 5 hours per week in the classroom under the guidance of the lecturer, including rapid prototyping, analysis and user testing.

The project is assessed and graded based on a final presentation of the project to the lecturer and on the spot coding.

4. Facilitation of Intrinsic Motivation in Module Project Work

In section 2, it is discussed that motivation comes from within a person and schools' responsibilities are to provide the environment that will enhance students' motivation to pursue academic goals actively. Now let's look at how IM is tapped in ET0706 module project work in terms of RAMP.

4.1. Relatedness

During the 3--4 week project development time, lecturers walk around in the classroom to help solve any technical problem faced by students. Immediate feedback will be given to students to adjust their project functionality implementation based on their project development progress. Students are free to walk around to discuss and learn from their peers on how to solve similar problems. Students who still feel lost or shy to ask for help are paired up with another student with good programing skills under mutual agreement.

4.2. Autonomy

As mentioned in section 3, the module project idea is chosen by students. Students have the freedom to decide on what problem to solve, and how to solve it. Although the official project implementation time started from after Lab Test 2 till the week before final exam, the student can choose to start to implement it earlier as long as the concept paper is approved by his lecturer. The student can also choose to submit the implemented project work earlier once the lecturer confirms that the quality of the completed project fulfils project assessment criteria. Students have the freedom of time. Although the module project is an individual project, students are free to discuss it with his peers to seek advice on to how solve particular problems encountered during project implementation period. Students have the freedom of whom to discuss with and receive advice from when help is needed.

4.3. Mastery

Before the implementation of the solution to the problem presented in students' project concept paper, all the teaching content has been covered during lecture sessions and applied in weekly simplified programming exercise during practical session. The process of working on a module project is to apply all that learned to solve a more complete real-life problem. Through the 3—4 week long project development work, the student with weaker programming background can take this opportunity to strengthen his module foundation knowledge; students with stronger programming skills can take the opportunity to learn and apply more advanced knowledge which is beyond the module syllabus and demanded by industry.

4.4. Purpose

As students are encouraged to work on the project to solve real-life problems, such as those faced by communities, they will feel that it is purposeful to do the project and have the desire to implement it well.

5. Discussion

Listed below were some of the student's module projects intended to solve real-life problems:

- Energy Conserver^{+}: To develop an app to check and monitor the energy usage and efficiency of users' household appliances. It aims to raise the public awareness on energy usage and wastage, thus instilling the sense of energy preservation either for the sake of reducing their electricity bills or to conserve the environment by starting the effort from domestic scope.
- Carbon Footprint Calculator: To develop an app to calculate the carbon footprint that each individual produces and to raise their awareness on that they could be potential causes to global warming as well. Upon calculation, tips will be given to help individuals to help reduce carbon footprints.
- Multi-language Form: To develop an interactive interview/feedback form suitable for various races by providing multiple language text and multiple language voice prompt.
- Smart Talking Book: To develop a book printed on dotted paper with bi-lingual texts and braille words, and a penlet application to help visually

impaired kids to read books using smart pen, either by themselves or together with their friends,

- War of Network: To develop a game to help students to learn computer networking related modules with ease and fun.
- etc.

The first two projects were developed to address the problems in energy area. “Multi-Language Form” project proposal was selected and funded for implementation by one of the government organization. “Smart Talking Book” project was an enhanced version of past semester module project. The current batch student redeveloped it based on the feedback from one of the local school after being tested by their visually impaired students. Project “War of Network” was developed in response to the DCPE course chairman’s call for more learning apps to assist current students in their module study. This project also received constructive advice from the coordinator of computer networking module.

Apparently, the above projects were undertaken by students with higher learning ability, and these students were achievement-oriented. In each of the above project, the student needed to acquire advanced knowledge beyond syllabus by himself. They are highly intrinsic motivated when working on the task-specific projects (Elliot, Andrew J., Harackiewicz & Judith M., 1994). The student working on “Multi-Language Form” stated in his project proposal, “We’re keen to apply our knowledge to solve real-life projects so as to give back to the community.” For the students who were high in achievement orientation, performance approach goals were set for them. They were intrinsically motivated to complete the challenging real-life project with good quality.

However, there are students low in achievement orientation and struggling in the module study. To achieve the highest levels of intrinsic motivation for these students, mastery approach goals were set for them (Elliot, Andrew J., Harackiewicz & Judith M., 1994). They were encouraged to work on projects with an appropriate level of challenge which mainly required fundamental understanding of the module. By working on the project with difficulty level corresponding to their learning capability, they had more time to practise and master fundamental skills. They felt safer and became more confident, hence were more willing to try to complete the main function of their project, rather than simply gave up.

Besides the mastery approach, peer tutoring was also provided to assist these students who were low in achievement orientation and struggling in the module study. Peer relationships are an important source of support, companionship, and social development for their age group. In the peer tutoring, the tutor, who was the student volunteer, helped the tutee in understanding the module, but not to do the project work for him. One repeat student chose to develop a Java application for his uncle and other movie rental shops owner to speed up the rental process and cut down on manpower. With the help of the peer tutor, he felt more confident to implement the features stated in his concept paper with better understanding of basic OOP.

Students were encouraged to take responsibility for their own learning. They updated their project development progress weekly; they were also involved in self-evaluation against project assessment rubric.

In the span of the project development phase, the students received help and instant feedback that enhanced self-efficacy and mastery from lecturer, peers and users. Students felt a sense of achievement when they made progress in the project. Through the student’s sense of accomplishment and vision for the future, the intrinsic motivation was spawned and sustained.

6. Conclusion

This teaching practice shared about how IM was tapped in course project work in Singapore Polytechnic. A safe and supportive environment is provided to students. As a result, students with higher learning ability are motivated to acquire advanced knowledge demanded by industry to work on more challenging projects to solve real-life problems; students who are struggling and low in achievement orientation are more engaged and intrinsically motivated to grasp the foundational knowledge to solve real-life problems with adequate difficulty level. It helps in preparing students to be work ready, future ready and eventually world ready.

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