LIU04363

Project-Based Learning and Students' Motivation: The Singapore Context

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Abstract

The Project work (PW) initiative was introduced by the Ministry of Education, Singapore, to provide students with the opportunities to foster collaborative learning skills, to improve both oral and written communication, to practise creative and critical thinking skills, and to develop self-directed inquiry and life-long learning skills (Ministry of Education, 1999). Although PW has been introduced for a few years, there has not been much research done in the Singapore context, especially in terms of its effect on students' motivation. To fill the empirical gap, this study examined the extent in which PW promoted students' intrinsic motivation, as well as satisfied students' needs for competence, choice and relatedness. Specifically, data was collected from 7 classes of Secondary 2 students with the use of a modified version of the Intrinsic Motivation Inventory (IMI, McAuley, Duncan, & Tammen, 1989) to assess students' intrinsic motivation and their perceived choice, competence and relatedness in the PW context and in their normal mathematics or science lessons. Comparisons were made to establish whether there was any significant difference in terms of the students' experiences in the different learning contexts.

Keywords: Project work, motivation, self-determination theory

Introduction

The Project work (PW) initiative was launched in 2000 by the Ministry of Education, Singapore, to better prepare its students for the challenges of the 21st century and to achieve the country's vision of Thinking Schools, Learning Nation (TSLN). The aims of PW are to provide students with the opportunities to foster collaborative learning skills, to improve both oral and written communication, to practise creative and critical thinking skills, and to develop self-directed inquiry and life-long learning skills (Ministry of Education, 1999).

Since the implementation of PW, a number of studies have looked at students' perceptions of PW at junior college, secondary and primary levels (Chang, 2004; Quek & Wong, 2002). For instance, Chang and Chang (2003) found that most of the junior college students surveyed (N = 567) believed that their engagement in PW has improved their communication and collaboration skills. They also affirmed that it has enhanced their thinking and problem-solving skills. Likewise, Tan's (2002) study of secondary school boys (N = 70) revealed that the experience of PW had positive effects on teamwork and communication skills, problem-solving and thinking skills, as well as self-regulation skills, whilst Chua's (2004) study of primary five students (N ≈ 120) showed that the students had positive perceptions of their attainment in the four main domains of cooperation, knowledge application, communication and independent learning. In essence, there is a general consensus that the objectives of PW are being met and that students have benefited, be it cognitively or socially, from their engagement in PW. Nonetheless, not much is known about the effect of PW on students' affect or motivation. Considering that PW is a non-examinable subject, it would be interesting to know how students' level of motivation in PW compares with their levels of motivation in other examinable subjects.

Students' Motivation and Project Work

The self-determination theory (SDT, Deci & Ryan, 1985, 1991) is one of the most comprehensive and empirically supported theories of motivation today (Pintrich & Shunk, 2002). It is a key explanatory system for the understanding of volitional behaviours (Deci & Ryan, 1985).

According to the SDT, human beings have three innate psychological needs - needs for choice (autonomy), competence and relatedness that are crucial for the development of the self in terms of growth and personal well-being. The need for choice is defined as the need to feel ownership of one's behaviour (deCharms, 1968). The need for competence refers to the need that individuals want to produce desired outcomes and to experience mastery and effectiveness when dealing with their environment (Harter, 1978; White, 1959). The need for relatedness pertains to the feeling that one is close to and belongs to a social group (Ryan, 1993). The SDT model proposes that all individuals desire to feel autonomous, competent and related and that if these three needs are satisfied, intrinsic motivation for doing the activity will increase. In contrast, if the three needs are not supported, intrinsic motivation will decrease.

PW is essentially a form of cooperative learning. It works on the basic assumption that when group members are linked together in such a way that they cannot succeed unless the group succeeds, they will help each other to ensure that the task is completed and the

group's goal achieved (Deutsch, 1949). They do this by providing help and assistance with the task, sharing resources, and encouraging each other (Gilles, 2004). Several studies have reported that cooperative learning has positive effects on students' level of motivation (Gardner, Mason, & Matyas, 1989). In fact, many have argued that the procedures of cooperative learning are designed to enhance intrinsic motivation because of its emphasis on a high level of autonomy in deciding the 'what' and 'how' of projects, as well as the chance to assist and work closely with their peers (Ames, 1984, 1992; Ryan, Connell, & Grolnick, 1992; Ryan & Grolnick, 1986; Shachar & Sharan, 1994; Sharan & Sharan, 1992). Nonetheless, the majority of studies conducted on cooperative learning and motivation were carried out with students in primary schools, and none of them was conducted in the Singapore's PW context. To fill the empirical gap, this study looked at students' intrinsic motivation and their perceived choice, competence and relatedness in the PW context and in their normal mathematics or science lessons. Comparisons were then made to establish whether there was any significant difference in terms of the students' experiences in the different contexts. Specifically, the study attempted to answer the following research questions:

1. Are perceived choice, competence and relatedness significant predictors of students' motivation in the PW context?
2. Is there any significant difference between students' motivation and their perceived choice, competence and relatedness in the PW context and in their mathematics lessons?
3. Is there any significant difference between students' motivation and their perceived choice, competence and relatedness in the PW context and in their science lessons?

Method

Sample

The participants consisted of 254 Secondary 2 students from 7 schools who took part in a large scale research project entitled 'Student-centred Learning in the context of PW'.

Procedure

At the beginning of the academic year, students who were involved in the research project were grouped into 68 project groups with the help of their PW teachers. Each PW group consisted of between 4 to 6 students from either two or three schools. The students were taught how to use the Knowledge Community platform, and they did most of their project discussion with their counterparts from the other schools in the asynchronous online discussion environment. The main advantage of using the platform was that it captured the students' discussions, thus making their thinking 'visible' to their PW teachers.

The duration of PW was 10 weeks. Two periods (1¼ hours) were allocated per week for PW, which were used by the PW teachers to facilitate students' learning and teach them just-in-time skills. Time was also set aside for the students to log on and discuss with their counterparts from the other schools. Within the 10-week period, the students had two face-to-face meetings. The first time was to finalise their project proposal, and the second time was to finalise the details of their presentations and products. Both meetings

were facilitated by their PW teachers and the researchers who were involved in the research project.

At the end of the study, the students were asked to fill in a questionnaire to assess their intrinsic motivation in the PW context. Thereafter, half of the sample was randomly selected to fill in a questionnaire to assess their intrinsic motivation in their normal mathematics lessons, while the other half filled in a corresponding questionnaire for their normal science lessons.

Measures

Modified versions of the Intrinsic Motivation Inventory (IMI, McAuley et al., 1989) were used to assess students' interest/enjoyment, and their perceived choice, competence and relatedness in the PW context and in their normal mathematics or science lessons. The interest/enjoyment subscale was used as the self-report measure of intrinsic motivation.

The IMI is an established questionnaire which has been used extensively in studies on intrinsic motivation and self-regulation (e.g., Deci, Eghrari, Patrick, & Leone, 1994; Plant & Ryan, 1985; Ryan, 1982; Ryan, Connell, & Plant, 1990; Ryan, Koestner, & Deci, 1991; Ryan, Mims, & Koestner, 1983). The IMI consists of varied numbers of items from these subscales, all of which have been shown to be factor analytically coherent and stable across a variety of tasks, conditions, and settings. In addition, McAuley, Duncan, and Tammen (1987) have also found strong support for its validity.

With respect to the current study, the interest/enjoyment, choice, competence and relatedness subscales all had high internal consistencies when used in the PW context, as well as in the mathematics and science contexts. Specifically, the internal reliability estimates of the subscales were as follows: interest/enjoyment alphas = .85 to .90, choice alphas = .71 to .78, competence alphas = .79 to .90 and relatedness alphas = .83 to .87.

Results and Discussions

To answer research question (1), a stepwise multiple regression was conducted to establish whether students' perceived choice, competence and relatedness were significant predictors of their intrinsic motivation in the PW context (see Table 1).

Table 1. Stepwise regression on the intrinsic motivation scale

Stepwise	Predictor	R^2	ΔR^2	F Change	β
1	Competence	0.244***	0.244***	80.41	0..494***
1	Competence	0.365***	0.121***	71.41	0.422***
2	Choice				0.356***
1	Competence	0.418***	0.053***	59.24	0.349***
2	Choice				0.269***
3	Relatedness				0.261***

***p<0.001

N = 254

The regression result affirmed that perceived choice, competence and relatedness were all significant predictors of students' intrinsic motivation in the PW context. They accounted for 41.8% variance of students' intrinsic motivation.

The finding provides support for the self-determination framework and is consistent with the findings of other earlier studies (e.g., Grolnick, Ryan, & Deci, 1991; Vallerand & Reid, 1984; Vallerand, Fortier, & Guay, 1997). Essentially, it suggests that if educators and teachers are keen to enhance the intrinsic motivation of their students, they should try to provide social contexts that satisfy or support the three basic needs for competence, choice and relatedness.

To answer research questions (2) and (3), two one-way repeated measures ANOVA were conducted for two different subgroups of students to examine potential differences between contexts (independent variables) using intrinsic motivation, choice, competence and relatedness scores as the dependent variables. The descriptive statistics are shown in Table 2.

Table 2. Descriptive statistics of the two subgroups of students in different contexts

	Subgroup 1 (n=116)				**Subgroup 2 (n=108)**			
	PW		**Mathematics**		**PW**		**Science**	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Intrinsic motivation	3.93	1.28	4.88	1.21	3.83	1.18	4.63	1.25
Choice	4.24	1.10	4.68	0.91	4.07	1.13	4.30	0.98
Competence	3.66	1.10	3.86	1.29	3.53	1.07	3.97	1.13
Relatedness	4.50	1.20	5.01	0.99	4.29	1.23	4.77	1.12

The results of the first one-way repeated measures ANOVA (subgroup 1) showed that the main effect of context was significant (Wilk's $\Lambda = .65$, $F(4,112) = 15.17$, $p<0.001$). Follow-up tests (ANOVAs) showed that the students' intrinsic motivation ($F(1,115) = 46.23$, $p<0.001$), choice ($F(1,115) = 14.26$, $p<0.001$) and relatedness ($F(1,115) = 19.96$, $p<0.001$) were significantly lower in the PW context as compared to the mathematics context.

Likewise, the results of the second one-way repeated measures ANOVA (subgroup 2) showed that the main effect of context was significant (Wilk's $\Lambda = .71$, $F(4,104) = 10.68$, $p<0.001$). Follow-up tests (ANOVAs) showed that the students' intrinsic motivation ($F(1,107) = 25.97$, $p<0.001$), competence ($F(1,107) = 12.85$, $p<0.005$) and relatedness ($F(1,107) = 17.87$, $p<0.001$) were significantly lower in the PW context as compared to the science context.

In essence, the results established that there are significant differences between students' motivation, perceived level of choice, competence and relatedness in the PW context and in their mathematics or science lessons. Since no other reviewed study has compared students' experiences in PW and in science or mathematics lessons, it is not known whether the results are typical.

It will be recalled that in the current study, PW was conducted using an asynchronous discussion platform instead of the traditional face-to-face discussion between group members. To a certain extent, it is possible that the use of the discussion platform could have contributed directly to the students' feeling of less personal involvement and relatedness. Considering that relatedness was a significant predictor of students' intrinsic motivation, albeit not the most dominant one, PW teachers may want to think of ways to build a 'social context' that supports relatedness in the virtual world. In this study, the students took part in a 'get-to-know-you' forum before they started their discussion on the project task. From the results of the study, it would seem that more has to be done to help the students build social connections with their group members before they go on-line. One possibility is to arrange for a face-to-face get-to-know-you session before the start of the projects and perhaps also extend the timeframe for the 'get-to-know-you' forum. Another option is to start a 'reflection' forum to encourage students to share their thoughts and feelings about their projects.

It is indeed noteworthy that the students in the current study felt that they had less autonomy when doing PW as compared to their normal mathematics lessons. The reason for the finding is not clear. The general assumption is that PW, like any other forms of cooperative learning, should give students more autonomy since they need to decide the 'what' and 'how' of their projects. The students in this study obviously did not share the sentiments. In view of the current findings, PW teachers may want to reflect on the way they facilitate their PW lessons. They need to check themselves to make sure that they are not being overly prescriptive in their enthusiasm to guide the students. They should try to let students make most if not all of the decisions.

In light of the fact that perceived competence was the most dominant predictor of students' intrinsic motivation, it is a cause for concern that the students had significantly lower level of perceived competence in the PW context as compared to their normal science lessons. The reason for the finding is again not apparent. In the current study, all the students went through a training session to familiarise them with the KC platform. There was no evidence to suggest that any of them had difficulty reading or posting messages, so it is unlikely that the perceived lack of competence was linked to the use of the discussion forum per se. Since PW was relatively new to the students, it is possible that their perceived lack of competence could reflect a more generic sense of anxiety or helplessness when faced with an unfamiliar task. It is also plausible that the project tasks that were designed by the PW teachers may have been too difficult for them to handle.

To address the problem, PW teachers may want to talk to their students and allay their fears before the start of PW assignments. It would also be helpful if they could provide an overview of what PW entails and how it would be evaluated so that students are more informed. Last but not least, they may want to take a closer look at the project tasks that they have designed to make sure that they are not too difficult for the students. In cases where the project tasks are really challenging, PW teachers may want to provide more scaffolds to guide the students, without diminishing their sense of autonomy.

Conclusion

Students who are intrinsically motivated for doing schoolwork are 'more likely to stay in school, to achieve, to evidence conceptual understanding, and to be well adjusted' than students who are more extrinsically motivated (Deci, Vallerand, Pelletier, & Ryan, 1991, p. 332). In this view, if policy makers and educators in Singapore are genuinely striving to achieve the PW objectives, particularly, that of developing students' self-directed inquiry and life-long learning skills, then there is an urgent need for them to look into what schools can do to provide social contexts that will enhance students' intrinsic motivation by supporting their needs for competence, choice and relatedness.

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