The Impact of Grading on Student Motivation and Learning Outcome in Project-Based Learning.

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Abstract— This paper examines the impact of extrinsic motivational factors such as grading on student motivation and on their perception of learning in the context of project-based learning. The analysis is based on collecting data from a control-group (N=47) and a test group (N=52). Both groups were exposed to the same type of assignment and expectation except that the project assignment in the test group counted for 40% of the total grade in the subject. Analytical and descriptive statistical methods were then used to compare the results from the two groups. The preliminary results suggest that grading as extrinsic motivational factor has no significant impact on student motivation. This result may further support the perception that project-based learning assignments by nature sustain student motivation. That is introducing grading or any other forms of reward does not impact student motivation. The results further indicate that grading improves significantly student perception of own learning.

Keywords— *Project based-learning, motivation, grading, learning outcome, reward*

I. INTRODUCTION

Research efforts on smart cities recognized the need for smart learning methods to develop university graduates with modern knowledge, practical skills and collaborative attitudes. Smart learning requires among other things instructional tools that are learner-centered, able to sustain student motivation, collaborative and application and content focused [1]. Among the learning methods that are considered learner-centered and supports collaboration is Project-based learning (PjBL) [2, 3]. Compared to other instructional methods, PjBL has several proved advantages, for example LaForce, Noble and Blackwell [4] argued that PjBL impact positively students attitudes and interest in the subject matter. Other scholars suggested that PjBL improved creative thinking and helped students developing soft communication skills [5]. Herber, Deshmukh, Mitchell and Allison [6] suggested that PjBL helped students to reduce the gap between theory and practice while Mantawy, Rusch, Ghimire, Lantz, Dhamala, Shrestha, Lampert, Khadka, Bista, Soni, Shaik, Lujan, Boyd, Pickings and Mabrich [7] demonstrated that PjBL increases effectiveness in the learning process. Others have shown that PJBL could be used to help students to learn to relate better to new emerging fields of practices [8].

In spite of its popularity, there are many challenges associated with the implementation of project-based learning [3]. These challenges are related to aspects such as collaboration, motivation, and organization. For example, the completion of PjBL tasks requires students to sharing equal levels of responsibilities [9]. Student autonomy was also emphasized as an important component in PjBL [3]. Conducting PjBL requires also multiple supports so that students can systematically implement their plans [10]. Significance of collaboration has also been emphasized by several scholars. For example, Tseng, Chang, Lou and Chen [11] and Miller and Hadwin [12] argued that setting up a collaboration framework is needed before students can actually develop and execute their tasks. Edelson, Gordin and Pea [13] and Hussein [14] have shown that students should apply a structured project management approach to project tasks combined with a mind-set that recognize the importance of adaptability and flexibility in order to address collaboration challenges in PjBL.

A. Motivation in PjBL

In project-based learning literature, there is a consensus that PjBL requires more from students compared to other instructional methods. Students are supposed to develop plans, gather information, evaluate the quality of information, constantly evaluate performance and their approach. All these expectations requires substantial motivation on the students parts in order to sustain all these efforts [15]. Motivation is therefore an important success factor in PjBL because motivation induces certain behaviors such as affective commitment and give a sense of direction [16]. It is suggested that motivation to learn is caused by a combination of intrinsic and extrinsic factors. Intrinsic factors refers to student involvement in an activity for its own sake while extrinsic motivation refers to motivation that arise because of the desire to gain some external reward or out of some external pressure [17]. Research on learning and motivation favors intrinsic motivation and sees it as more important and effective than extrinsic motivation. According to Ocak and Uluyol [18] students with extrinsic motivation utilized less complex learning strategies and were less successful in tests compared with students with intrinsic motivation.

In project-based learning there is a rooted assumption that PjBL itself increase student intrinsic motivation because it gives students opportunity to be involved in the learning process and in the production of authentic products. Other scholars have argued that PjBL 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 [19]. There is a consensus that project-based learning assignments because of their emphasis on authentic products, are seen to maximize students motivation [3].

The relationship between students intrinsic motivation compared with extrinsic motivation in the context of project based-learning is not clear. There are few studies that examine the impact of extrinsic motivation in the context of project-based learning. Liu, Wong, Divaharan, Peer, Quek and Williams [19] have compared the effect of PjBL on student motivation with other graded subjects and they found that the level of motivation in PjBL is less compared to other examinable subjects, even though students report that they have benefited from their projects experience. Student motivation can as well be improved by focusing on what type of challenges the students will face during implementation of

the project. According to Blumenfeld, Soloway, Marx, Krajcik, Guzdial and Palincsar [2] project tasks that are authentic are also thought to promote students' motivation.

Grading is a form of reward/punishment and is considered to be an extrinsic motivational factor that might enhance student motivation but it is effect is not fully understood in the context of project-based learning. In this paper, we seek to shed the light on the impact of grading on student motivation. The first objective of the paper is therefore to evaluate the following hypothesis:

H1: Grading the project-based assignment will not impact students motivation.

B. Perception of Learning Outcome in Project-Based Learning

Many scholars suggested that PjBL offer several advantages regarding achieving intended learning outcomes. For example, Boaler [20] argued that PjBL as an instructional method is suited to teach mathematics to college students. Some scholars have as well concluded that PjBL improves retention level among students [21]. Ralph [22] studied the application of PjBL in Science, Technology, Engineering and Management Education and found that PjBL has positive impact on learners acquisition of knowledge. On the other hand, some scholars challenged this view and argued that the effect of PjBL on learning compared to other traditional methods is not conclusive [23, 24]. These studies confirmed that using PjBL might have increased students perception of learning without having any proof that PjBL actually does so. Some studies compared PjBL with inquiry-based learning (InBL) and found no significant difference between the two methods concerning acquisition of knowledge or skills development [25]. Guo, Saab, Post and Admiraal [26] distinguish between three types of learning outcomes that could be achieved using PjBL. These outcomes are: 1) Affective outcome, this form of outcome is evaluated by students to assess how they perceived the learning experience. According to Guo, Saab, Post and Admiraal [26] this form of learning outcomes were the mostly studied within PjBL. 2) Cognitive outcomes, this learning outcome refer to the achievement of intended knowledge, and 3) behavioral outcomes which refer to the achievement of soft skills such as collaboration and communication skills. Most of the studies that evaluate the impact of project-based learning on student perception of learning do not consider the moderating or mediating effect of grading on the student perception of learning and therefore the second objective of this paper is to investigate the following hypothesis:

H2: Grading the project-based assignment will not impact students perception of learning outcome.

II. RESEARCH DESIGN AND METHOD

In order to test the hypotheses, I used a control group and a test group. Both groups were given the same type of project-assignment. In the control group, the assignment was compulsory but not graded. Students were only required to complete the assignment and deliver the final product. In the test group, the assignment was graded and counted 40% of the total score of the subject. Upon conclusion and after completing the assignment the students enrolled in each group were asked to answer a questionnaire in order to collect the students perceptions on their level of motivation and perception of learning. The study uses both analytical and descriptive statistical methods in order to test the hypotheses. From the test group, 52 students delivered valid responses and from the control group, 47 students delivered valid responses. First we shall present a short description of the project-assignment and thereafter present the findings.

A. The Project Assignment

The assignment was intended to follow to the following principles for both the control group and test groups [27]:

- The assignment should result in an authentic digital product

- The assignment requires input from multi-disciplinary team

- The assignment should extend over defined period of time with clear start and end dates

- Teaching staff has an advisory role. Student groups had full autonomy regarding the choice of their final product

- The size of each student group was between 4–8 students

The assignment was executed using stage gate model as shown in Figure 1.

Fig. 1. Project stages.

B. Data Analysis

The findings presented in this paper will be based on quantitative analysis. For this purpose, we collected data from the questionaries that was submitted by the students from each group. On each questions students were asked to indicate their support for each argument in the questionaries on a Likert scale from 1 to 5 where 5 means strongly agree and 1 means strongly disagree. Students in both groups were asked to indicate their support to the following questions:

1) I have been motivated to work on the project assiognments.

2) Working on project assignment have contributed to my learning in the subject

III. FINDINGS

Several statistical tests has been conducted in order to examine the findings of the study. All tests were conducted in SPSS-software. Table 1 shows an overview over the mean and

the standard deviation for each group on the impact of the PjBL on motivation and on their perception of learning.

TABLE I. THE MEAN AND STANDARD DEVIATION OF STUDENT RESPONSES FROM EACH GROUP

Variable	Group	Mean	Std. Deviation
Student Motivation	Control group	3.21	1.122
	Test group	3.33	1.184
Impact on learning	Control group	2.70	1.214
	Test group	3.92	.947

The results shown in Table 1 clearly indicate that the respondents in the test group evaluate the impact of the PjBL on their learning significantly higher (Mean = 3.92) than the students in the control group (Mean = 2.70). The results also indicated small differences in the means on student motivation. Independent sample T-test was then conducted in order to further compare the means between the test group and the control group and results of this T-test is shown in Table 2.

TABLE II. RESULTS OF THE INDEPENDENT SAMPLES T-TEST OF CONTROL GROUP AND TEST GROUP

Impact	t-test for Equality of Means	P-value	Mean Difference	Std. Error Difference
Motivation	-.491	.624	-.114	.232
Learning	-5.608	.000	-1.221	.218

The findings shown in Table 2 suggest that as far as student motivation is concerned the results show that there are no significant difference between the two groups in terms of student motivation (p-value = 0.624). The results further suggest that although student motivation is not affected by introducing grading, the results shows that students in the test group tend to evaluate the impact of the project on their learning much higher than those students in the control group. The results indicate that there is significant difference between the two groups (with p-value of <0.000). Furthermore, both H1 and H2 were tested using Whitney U-test to measure the distribution of student answers in both groups. The summary of the test is shown in Table 3.

TABLE III. RESULTS OF INDEPENDENT-SAMPLES MANN-WHITNEY U TEST. THE SIGNIFICANCE LEVEL IS AT 0.05

Null Hypothesis	Signficance level	Decision
Grading the project-based assignment will not impact students motivation.	.624	Retain the null hypothesis.
Grading the project-based assignment will not impact students perception of learning.	.000	Reject the null hypothesis.

On student motivation, the results of the test shows that the null-hypothesis should be retained since is there is no significant difference between the distribution of students answers on the impact of grading on motivation. On the other

hand, results suggest that the null-hypothesis on the impact of learning should be rejected as there is significant difference between the two groups on the impact on their learning (significance level is = 0.000). Figure 2 shows as well the frequency of student answers from each group on questions related to motivation and learning. On learning, Figure 2, shows a mean rank of 62.98 for the test group while the control group scored a mean rank of 35.6. These results further confirm that there is a significance difference between the two groups regarding students perception of their own learning.
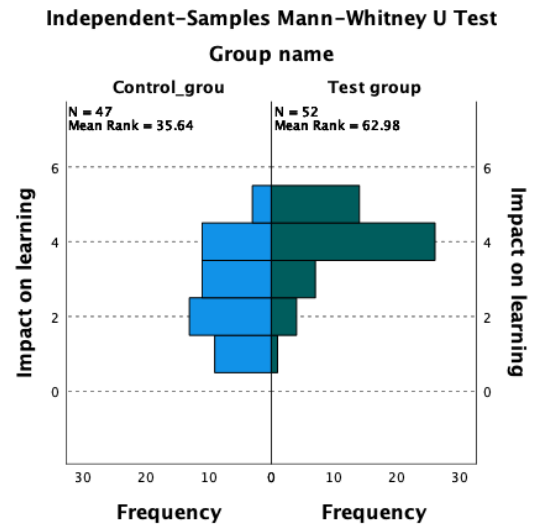

Fig. 2. Mean rank of student learning from both groups

On the question related to motivation, the differences of the mean rank between the two groups is quite marginal as shown in Figure 3.
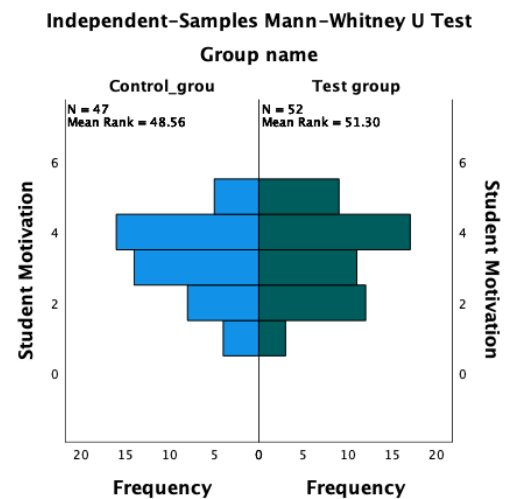

Fig. 3. Mean rank of student motivation from both groups

IV. DISCUSSIONS

The findings from this study suggest clearly that student motivation has not been influenced by extrinsic factors such as using grading to assess the project assignments. This may confirms previous studies that the project-assignment itself

provides the context for sustaining student motivation. This finding is in line with many previous study that confirm PjBL sustain student intrinsic motivation because the method gives students opportunity to be involved in the learning process [19]. And in this particular case, the student motivation was sustained since the assignment was aiming at the production of authentic products. Involving students in the production of authentic products provided students with a chance to understand the practical implications of managing the project from a life cycle perspective. This is in line with recommendation by Blumenfeld, Soloway, Marx, Krajcik, Guzdial and Palincsar [2] that all the activities should be designed to achieve an important intellectual purpose. Experiencing the life cycle of the project seems to have a considerable impact on student motivation far more than grading. In addition motivation has been sustained because the assignment enabled students to take advantage of their own creativity and their proximity to the target group [28]. It is evident that taking advantage of student creativity as well as their narrowness to the target group appears to be a contribution factor to sustain motivation. Students, in the context of the assignment were both producers of learning resources as well as recipients of the learning resources. Students therefore existed on the both ends of the learning cycle, this may have as well increased their motivation.

As far as impact on learning is concerned, evidence from the findings suggest that grading have indeed influenced student perception of their own learning. Previous studies have focused on various dimensions that makes project-based learning effective and have given little attention to the impact of grading as an extrinsic factor. Most of the studies suggested that learning is largely dependent on having clearly defined goals of the process around the project assignment. In addition, several studies have focused on identifying scaffolders that could support student learning within the context of project-based learning [29]. Most of the studies on project-based learning are focused on assessing the impact of PjBL on academic achievement and the conclusion from these studies is that the impact of PjBL is not conclusive. We may therefore argue that grading could improve students perception of their own learning and this improve their commitment to their tasks.

V. Conclusions

The findings from the study points out to two main conclusions. The conclusions may help educators and supervisors to design and implement project-based learning assignments that sustain student motivation and increase the student perception of their own learning. First, introducing external motivational factors such as grading does not contribute or change the student motivation. Student motivation remains unaffected by grading. Students motivation on the other hand could be improved by selecting the type of assignments that gives wider room for students to be creative, by focusing on producing authentic products that could have value for others. This seems to give more meaning and sustain student motivation.

As far as grading is concerned, findings suggest that grading impact largely students feelings that they learn. This finding is however not supported by any factual data that learning or knowledge acquisition becomes higher if the assignment becomes subject to grading. Further investigation is needed in order to assess the impact of grading on knowledge acquisition and on learning strategies by students.

The impact of grading needs as well to be investigated on issues related to organizing, collaboration and on the teachers roles within project-based learning.

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