

How Does the Frequency of Instructor Feedback Affect Perceived Loafing and Team Performance in Team Project-Based Learning? A Moderated Mediation Approach

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This study focuses on the instructor's role in student-centered learning and aims to test the effects and moderating role of instructor feedback on perceived loafing in team project-based learning. A conditional effect model including team efficacy, perceived loafing, instructor feedback, and team performance was proposed. Data were collected from students who registered for team project-based learning courses at a university in South Korea. A total of 420 cases were subjected to moderated mediation analysis. The results demonstrated that instructor feedback was negatively related to perceived loafing and moderated the relationship between team efficacy and perceived loafing. Furthermore, instructor feedback moderated the relationship between perceived loafing and team performance. In particular, even when perceived loafing was high, students who received frequent instructor feedback were found to significantly reduce the damage to team performance. Based on these findings, the importance of instructors' facilitation in team project-based learning is discussed.

Keywords : Team project-based learning, Instructor feedback, Perceived loafing, Team efficacy, Team performance, Moderation

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Introduction

The goals of 21st-century education extend beyond knowledge acquisition to endeavors such as pursuing higher-order thinking skills, interpersonal skills, and lifelong learning skills. Furthermore, employers across all disciplines commonly expect college graduates to have teamwork, communication, ethical decision-making, critical thinking, and knowledge application as the most important job skills (Association of American College and Universities, 2011; Hart Research Associates, 2015). These competencies can be effectively achieved when students engage in complex problem solving and collaborative learning. In this respect, team project-based learning (TPjBL) has attracted attention in the higher education. Students undertaking TPjBL endeavor to collaboratively produce solutions or artifacts on a specific topic while they are naturally encouraged to practice communication, leadership, decision-making, and teamwork skills in a diverse context (Bjorklund et al., 2004; Borrego et al., 2013; Burnik & Košir, 2017). Therefore, TPjBL is considered a valuable instructional strategy to improve student employability (Burnik & Košir, 2017; Whatley, 2012).

Although TPjBL offers many benefits, several studies (Borrego et al., 2013; Frash et al., 2004; Hall & Buzwell, 2013; Peñarroja et al., 2017) have reported that students often feel frustrated with unequal workload among team members. Social loafing is “the tendency of individuals to exert less effort when working collectively than when working individually” (Borrego et al., 2013, p. 487). Social loafing is the most prevalent negative team behavior and may harm team cohesion, climate, motivation, and interaction (Maiden & Perry, 2011; Mulvey & Klein, 1998; Peñarroja et al., 2017). Karau and Williams (1993) expressed significant concern because social loafing occurs across genders, cultures, and tasks, and scholars (Frash et al., 2004; Karau & Williams, 1993) call for more research on the factors associated with it and the potential moderators that decrease it. Moreover, instructors and educational

practitioners need to have a profound understanding of the dynamic and complex team learning process to foster positive learning outcomes (Frash et al., 2004).

Accordingly, in this study, variables related to improving team performance and reducing the negative effects of perceived loafing were selected in TPjBL, and the dynamic relationships between the research variables were investigated. In team learning literature, team efficacy is considered a robust positive predictor of effective team process and performance (Gully et al., 2002; Rapp et al., 2021). Teams with high efficacy tend to tackle difficult tasks while actively sharing knowledge and information. Furthermore, team efficacy can not only be an effective antecedent to reduced perceived loafing (Hasan & Ali, 2007; You, 2020), but also encourage teams to engage in challenging projects, thereby enhancing their performance. Therefore, this study includes team efficacy as a predictor of team learning and examines its relationship with perceived loafing and team performance.

Additionally, a student's project learning experience quality can depend on the extent to which the instructor supports students' learning in TPjBL. Just as the role of students changes in a learner-centered environment, instructors are also expected to change their roles to become learning facilitators, guides, and mentors. Several studies highlight the instructor's role in team learning, including the instructor's feedback and frequent interactions with students (Bjorklund et al., 2004; Kaendler et al., 2015; You, 2020).

As instructors' facilitation is critical to promoting students' active engagement, this study focuses on the role of instructor feedback in TPjBL and examines the how it affects students' team learning behavior and performance. Particularly, this study explores whether the frequency of instructor feedback has a moderating effect on perceived loafing. In this respect, the present study will contribute to highlighting the importance of the instructor's feedback behaviors in TPjBL by enhancing team performance and reducing the negative effects of team loafing.

The Theoretical Background

Team project-based learning

TPjBL is an instructional strategy where students work together on authentic, ill-structured problems while collecting relevant information, analyzing data, and integrating knowledge and skills to generate solutions or products (Whatley, 2012). TPjBL students must deal with real-world problems, complex tasks, uncertainty, and team dynamics while actively planning and undertaking the projects. Experiencing TPjBL contributes to achieving various learning outcomes. It fosters critical thinking, intellectual development (Wengrowicz et al., 2017), collaboration (Borrego et al., 2013; McManus & Costello, 2019), motivation (Velez & Power, 2020), task initiation, time management skills, self-control, metacognition, and flexibility (Krauss & Boss, 2013). Furthermore, because TPjBL at university level handles professional industry problems, it is recognized as an effective way for students to use discipline-specific knowledge, learn skills, and prepare for competitive job fields (Whatley, 2012). Burnik and Košir (2017) demonstrated that engineering students who participated in industrial product design projects improved their engineering competences, showed greater confidence in their future careers, gained better understanding of occupational requirements, and improved their soft skills, such as collaborating and coordinating with diverse people. However, TPjBL does not always guarantee a successful learning experience. The following section reviews some key factors affecting students' learning experience in TPjBL.

Instructor feedback

TPjBL is a form of student-centered learning, where students determine their own learning path and take responsibility for their learning. Kim and Jang (2018) highlighted that the ability to provide timely and appropriate feedback and facilitation

in student-centered learning is an essential competency for instructors. However, several studies have noted that instructors are often burdened because they do not have sufficient skills and competencies to successfully implement team-based and student-centered learning (Gillies & Boyle, 2010; Kim & Jang, 2018; Riebe et al., 2016; Ruys et al., 2011). Burbach et al. (2010) and Kaendler et al. (2015) emphasized that teachers and pre-teachers should be trained in the pedagogies of collaborative learning.

Terms such as ‘scaffolding’, ‘feedback’, and ‘teacher-student interaction’ appear frequently in student-centered learning literature. These terms are used interchangeably to describe instructors’ engagement in students’ team learning. Scaffolding is defined as the “support given by a teacher to a student when performing a task that the student might otherwise not be able to accomplish” (Van de Pol et al., 2010, p. 274). Van de Pol et al. (2010) listed giving feedback, offering hints, instructing, explaining, modelling, and questioning as typical examples of scaffolding. Such scaffolding is known to promote students’ metacognitive and cognitive activities (Azevedo et al., 2005; Van de Pol et al., 2010). Moreover, instructor feedback includes correcting errors, suggesting sources of information, prompting challenging questions, and providing expert advice on project management and solutions.

A few studies have highlighted that positive learning satisfaction and outcomes can only be attained when instructors foster a high quality of student interaction and guidance (Dillenbourg & Tchounikine, 2007; Van de Pol et al., 2015) and monitor students’ learning at both the team and individual levels and intervene adequately (Kaendler et al., 2015; Van de Pol et al., 2010). Studies have also discussed that frequent instructor feedback as positively related to improved students’ group problem-solving skills, group communication skills, occupational awareness, job competence (Bjorklund et al., 2004), learning satisfaction, and team learning outcomes (Kim, 2017; Kim, 2019; You, 2020). Thus, this study paid attention to the frequency of instructor feedback and predicted the frequency of instructor feedback

in TPjBL to be closely related to the team learning process and performance.

Perceived loafing

Social loafing is “the tendency of individuals to exert less effort when working collectively than when working individually” (Borrego et al., 2013, p. 487). It is a negative factor that most persistently emerges in team learning research (Borrego et al., 2013; Frash et al., 2004; Jassawalla et al., 2009; Maiden & Perry, 2011; Peñarroja et al., 2017). However, regardless of whether social loafing actually occurs, the perception that other team members are working less than expected can disrupt team performance. This is called perceived loafing, which undermines task expectations, motivation, team climate and cohesion, and interactions among team members (Liden et al., 2004). Mulvey and Klein (1998) warned of the incremental damage of perceived loafing, noting that the suspicion of others’ lack of contribution creates a vicious cycle that can continuously harm the team’s motivation and damage a creative and trustworthy teamwork environment. Perceived loafing negatively related to team cohesion and team learning satisfaction and also played a negative mediating role to team performance (Peñarroja et al., 2017).

It has been suggested that social loafing could be reduced if other team members and supervisors can easily recognize an individual’s effort and workload (George, 1992), and peer evaluation is frequently used to identify individual contributions. According to Brook and Ammons (2003), peer evaluation is better conducted at an early stage and administered multiple times, allowing instructors to detect problems early and provide timely interventions for students to improve. In summary, identifying individual contributions, detecting team conflicts, and providing appropriate instructor’s interventions may reduce the problem of loafing in TPjBL. Thus, researchers have stressed the importance of instructors’ determination to tackle this issue (Brooks & Ammons, 2003; Frash et al., 2004). This implies that instructor behaviors, such as actively interacting with students, monitoring team

processes, providing feedback on projects, and applying evaluation strategies, are critical in resolving social loafing.

Team efficacy

Team efficacy refers to the shared belief among members that their team will be able to perform tasks successfully (Bandura, 2002). However, team efficacy is unlikely to be equivalent to the sum of the self-efficacy of each member (Bandura, 1997) because even individuals with high self-efficacy may perceive team efficacy differently in a teamwork situation, and motivation and behavior in team tasks differ according to the degree of team efficacy.

Effective teams tend to be motivated and put in more effort (Fuller et al., 2006). Furthermore, team efficacy is positively related to challenges, experiencing team bonding, active collaboration, engagement (DeRue et al., 2010), project success (Hasan & Ali, 2007), learning achievement (Goddard, 2001), and team performance (Gully et al., 2002; Mulvey & Klein, 1998). A meta-analysis by Gully et al. (2002) concluded that team efficacy is the most significant predictor of team performance. Additionally, a significant negative relationship has been reported between team efficacy and perceived loafing (Hasan & Ali, 2007). In this context, this study predicts that team efficacy is an essential factor in TPjBL and examines the effects of team efficacy in TPjBL.

Research model and hypotheses

As mentioned above, team efficacy is a robust and important predictor of team achievement and performance (Gully et al., 2002) and has a negative relationship with perceived loafing (Hasan & Ali, 2007; You, 2020). Karau and Williams (1993) addressed the potential of moderating social loafing by providing feedback on team performance, monitoring the learning process, making individual performance

identifiable, making the team task meaningful, and facilitating an increase in team interaction. These findings imply that instructor feedback can be helpful in reducing perceived loafing and promoting team performance. Based on the above discussion, this study examines the relationship between team efficacy, perceived loafing, instructor feedback, and team performance by focusing on testing the moderating role of instructor feedback. A conditional process model was proposed (Figure 1), and the research hypotheses were as follows.

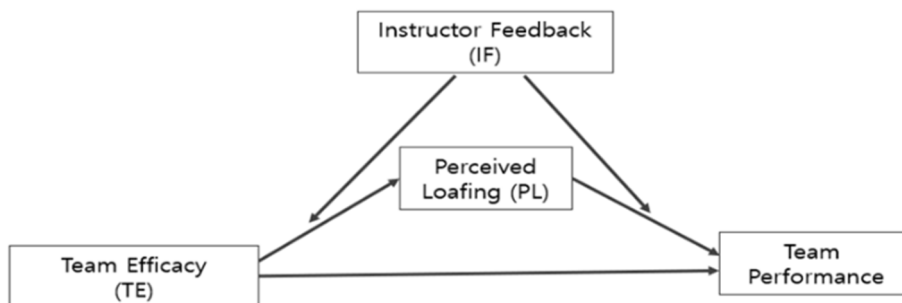


Figure 1. The research model

H1: Perceived loafing mediates the relationship between team efficacy and team performance.

H2: Instructor feedback moderates the relationship between team efficacy and perceived loafing.

H3: Instructor feedback moderates the relationship between perceived loafing and team performance.

H4: Instructor feedback moderates the indirect effect of team efficacy on team performance through perceived loafing.

Methods

Participants and procedure

This study was conducted at a four-year university in South Korea. The sample was drawn from students who took intensive four-week project courses in 2020 as part of their third-year coursework. A total of 30 academic majors opened the 44 project courses in the second semester of 2020, and 940 students were enrolled. Each course was taught by different instructor. Project topics were selected from industrial problems or social issues related to students' majors, and students produced prototypes, artistic products, or business proposals as outputs according to the characteristics of the project topic. For example, the project topic of the department of landscape architecture is "designing an open-space-based landscape plan", the topic of the department of fashion design is "start-up planning through prototype/brand development", and the topic of the department of applied statistics is "public problem-solving using and analyzing public big data". The classes were scheduled from Monday to Friday between 9:00 am and 12:00 pm; the class size was less than 30; lectures were kept to a minimum, but instructors answered students' project-related questions and provided feedback and evaluated students' presentations, reports, and project deliverables. Since the students were in their third year, they had previous team-learning experience. Attendance was checked, and many students worked extra hours.

Data were collected online twice, once at the beginning and once at the end of the courses. Participation in the study was voluntary. The study was exempt from the Institutional Review Board approval with local legislation and institutional requirements because the consents from participants were obtained, and no personally identifiable information was used. A total of 420 cases from 30 courses were collected and analyzed, comprising 201 men (47.9%) and 219 women (52.1%) aged between 20 and 30 years ($M=22.5$, $SD=1.46$). There were 82 students from the

College of Humanities and Social Sciences, 59 students from the College of Natural Sciences, 251 students from the College of Engineering, and 28 students from the College of Arts and Physical Education. The participants' majors varied across mechanical engineering, architecture, business, social welfare, computer science, English literature, industrial design, civil engineering, and fashion design.

Instrument

A total of 16 items in Korean (see Appendix A) were used. A survey was administered to measure team efficacy at the beginning of the project courses, and other research variables were measured right after their completion. The survey items were reviewed by three education faculty members to check content validity.

Instructor feedback. Instructor feedback was defined as the frequency of instructors' provision of feedback or consultation on the projects. Students were asked, "How often are feedback or consultations provided from instructors during and after the project classes?" The responses were coded 1= "nearly never", 2= "sometimes", and 3= "frequently (more than three times a week)".

Team efficacy. Five items from Kwon (2010) were used to measure team efficacy. A sample item is, "I am confident that our team has the adequate knowledge and skills to carry out the project". The items were measured with a 5-point Likert scale, ranging from 1 (*completely disagree*) to 5 (*completely agree*). The Cronbach's alpha was .92.

Perceived loafing. Four items from Mulvey and Klein (1998) were used to measure perceived loafing. A sample item is, "Some of our team members worked more than others". A higher score indicated more perceived loafing. The Cronbach's alpha was .79.

Team performance. Six items from Hoegl and Gemuenden (2001) were used to measure team performance. Two sample items are, “Our team was satisfied with the final project result” and “The team project was carried out in a time-efficient way”. The Cronbach’s alpha was .92.

Control variable. Given that team size is related to team process and performance (Wheelan, 2009), it was controlled for in the present study. Teams ranged in size from 3 to 8 ($M=4.63$).

Data analysis

IBM SPSS 26.0 was used to perform descriptive statistics and correlation analysis of the collected data. Mediation, moderation, and moderated mediation effects were tested using the PROCESS version 4.0 macro for SPSS (Hayes, 2021). *Conditional Process Analysis* is the integration of mediation and moderation analysis. It is used when one's analytical goal is to describe and understand the conditional nature of the mechanism or mechanisms by which a variable transmits its effect on another (Hayes, 2013). PROCESS is a widely used tool for estimating direct and indirect effects in mediator models, moderation models, and moderated mediation models. The continuous variables were mean centered before creating the product terms. Mean centering can be obtained by each score is subtracted from the mean and divided by the variable’s standard deviation. Although mean centering does not affect the statistical significance, it makes the interpretation of coefficients meaningful through a re-scaling process especially when moderation analysis is performed (Aguinis & Gotterredson, 2010). A significance level of .05 was used to test the hypotheses.

Results

Descriptive statistics and correlation analysis

Descriptive statistics of the research variables and correlations are presented in Table 1, and the frequency of instructor feedback is presented in Table 2. As shown in Table 1, the mean of instructor feedback was 2.39, and the mean of team efficacy was 4.49. The mean of perceived loafing was 2.29, and the mean of team performance was 4.39. Among the correlations between research variables, perceived loafing showed negative correlation with instructor feedback ($r = -.18$), team efficacy ($r = -.45$), and team performance ($r = -.46$). Positive correlations were found between instructor feedback and team performance ($r = .35$), between team efficacy and team performance ($r = .57$).

Table 1
Descriptive and correlational analysis results (N=420)

	<i>M (SD)</i>	1	2	3	4
1. team size	4.63 (1.55)	1.00			
2. instructor feedback	2.39 (.65)	-.36**	1.00		
3. team efficacy	4.49 (.62)	-.12*	.26**	1.00	
4. perceived loafing	2.29 (.97)	.10*	-.18**	-.45**	1.00
5. team performance	4.39 (.68)	-.10	.35**	.57**	-.46**

* $p < .05$, ** $p < .01$

According to student responses on instructor feedback in Table 2, 39 students (9.3%) reported that they rarely get instructor feedback; 178 students (42.4%) reported that they sometimes received feedback from instructors; and 203 students (48.3%) reported receiving frequent instructor feedback. The distribution of instructor feedback by colleges are also shown in Table 2.

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Table 2
Frequency of instructor feedback (N=420)

College	n	1 (rarely)	2 (sometimes)	3 (frequently)
Humanity and social science	82	3 (3.7%)	24 (29.3%)	55 (67.0%)
Natural Science	59	5 (8.5%)	30 (50.8%)	24 (40.7%)
Engineering	251	31 (12.4%)	114 (45.4%)	106 (42.2%)
Arts and physical education	28	0 (0%)	10 (35.7%)	18 (64.3%)
Total	420	39 (9.3%)	178 (42.4%)	203 (48.3%)

Testing for mediation effects

A simple mediating effect analysis was performed to test Hypothesis 1, and the proposed mediation model was tested using the PROCESS macro model 4 (Hayes,

Table 3
OLS regression results

Predictor	Model 1 (perceived loading)					Model 2 (team performance)				
	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% CI
constant	5.66	.33	16.98***	<.001	[5.00, 6.31]	2.74	.26	10.40***	<.001	[2.22, 3.26]
team size	.02	.03	.91	.36	[-.03, .08]	-.02	.02	-1.32	.19	[-.05, .01]
Team efficacy	-.77	.07	-11.74***	<.001	[-.90, -.64]	.49	.05	10.69***	<.001	[.41, .59]
Perceived loading						-.21	.03	-6.93***	<.001	[-.27, -.15]
<i>R</i> ²	<i>R</i> ² =.25, <i>F</i> (2, 417)=70.76, <i>p</i> <.001					<i>R</i> ² =.44, <i>F</i> (3, 416)=107.92, <i>p</i> <.001				

****p*<.001

2013). The results presented in Table 3 and showed that team efficacy was negatively related to perceived loafing ($b=-.77$, $t=-11.74$, $p<.001$), which in turn significantly affected team performance. The effect of perceived loafing on team performance was $b=-.21$, $t=-6.93$, $p<.001$. Model 2 accounted for 44% of the variance in team performance. Perceived loafing mediated the relationship between team efficacy and team performance: The indirect effect of team efficacy on team performance was .16, and the bootstrapping 95% CI was [.40, 59]. H1 was supported.

Testing for a moderated mediation effect

The proposed moderated mediation model was tested using the PROCESS macro model 58 (Hayes, 2013). There were two regression models, which tested the moderating effect of instructor feedback between team efficacy (TE) and perceived loafing (PL) (Model 1 in Table 4) and the moderating effect of instructor feedback between perceived loafing and team performance (Model 2 in Table 4). Team size was entered as a control variable. Table 4 presents the results of the analysis.

Model 1, shown in Table 4, revealed that instructor feedback significantly moderated the relationship between team efficacy and perceived loafing. The interaction of TE×IF was significant ($b=-.21$, $t=-2.06$, $p=.04$). Model 1 accounted for 27% of the variance in perceived loafing. As interaction term was added, the amount of change in R^2 was .01, which was statistically significant ($F(1, 415)=4.25$, $p=.04$). The result confirmed a significant moderating effect of instructor feedback.

To understand the moderating relationship, simple slopes were plotted (Figure 2). The graph showed that team efficacy reduced perceived loafing, and the effects differed at the different level of instructor feedback. High team efficacy with higher instructor feedback showed greater decreasing effect of team efficacy on perceived loafing. Thus, H2 was supported.

In Model 2 (in Table 4), the multiple regression analysis showed that team efficacy had a significant positive effect on team performance ($b=.46$, $t=10.14$, $p<.001$).

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Table 4
OLS regression results of moderated mediation

Predictor	Model 1 (perceived loading)					Model 2 (team performance)				
	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% CI
constant	-.01	.14	-.07	.95	[-.28, .26]	4.37	.08	54.36***	<.001	[4.21, 4.52]
team size	.01	.03	.24	.81	[-.05, .06]	.01	.02	.53	.60	[-.02, .04]
team efficacy (TE)	-.78	.07	-11.22***	<.001	[-.92, -.65]	.46	.05	10.14***	<.001	[.37, .54]
instructor feedback (IF)	-.13	.07	-1.82	.07	[-.26, .01]	.19	.04	4.70***	<.001	[.11, .27]
TE× IF	-.21	.10	-2.06*	.04	[-.41, -.01]					
perceived loading (PL)						-.19	.03	-6.63***	<.001	[-.25, -.13]
PL× IF						.13	.04	3.63***	<.001	[.06, .20]
R ²	R ² =.27, F(4, 415)=37.56, <i>p</i> <.001					R ² =.49, F(5, 414)=79.41, <i>p</i> <.001				
Conditional indirect effect of TE on team performance mediated by PL at the value of IF										
	Effect		BootSE		BootLLCI ¹		BootULCI ²			
IF (-1SD)	.18		.04		.10		.26			
IF (Mean)	.15		.03		.09		.21			
IF (+1SD)	.10		.04		.03		.18			
Pairwise contrast between conditional indirect effects (Effect1-Effect2)										
Effect1	Effect2	Contrast		BootSE		BootLLCI		BootULCI		
.15	.18	-.03		.03		-.09		.02		
.10	.18	-.08		.05		-.18		.03		
.10	.15	-.05		.03		-.10		.01		

¹LLCI: The lower level of the 95% confidence interval; ²ULCI: The upper level of the 95% confidence interval. Bootstrap sample size = 5,000. **p*<.05, ***p*<.01, ****p*<.001

Additionally, there were significant moderating effects of PL×IF (*b*=.13, *t*=3.63, *p*<.001) on team performance. This means that instructor feedback moderated the relationship between perceived loading and team performance. As interaction term (PL×IF) was added, there was a significant change in R² (*F*(1, 414)=13.16, *p*<.001, Δ*R*²=.02).

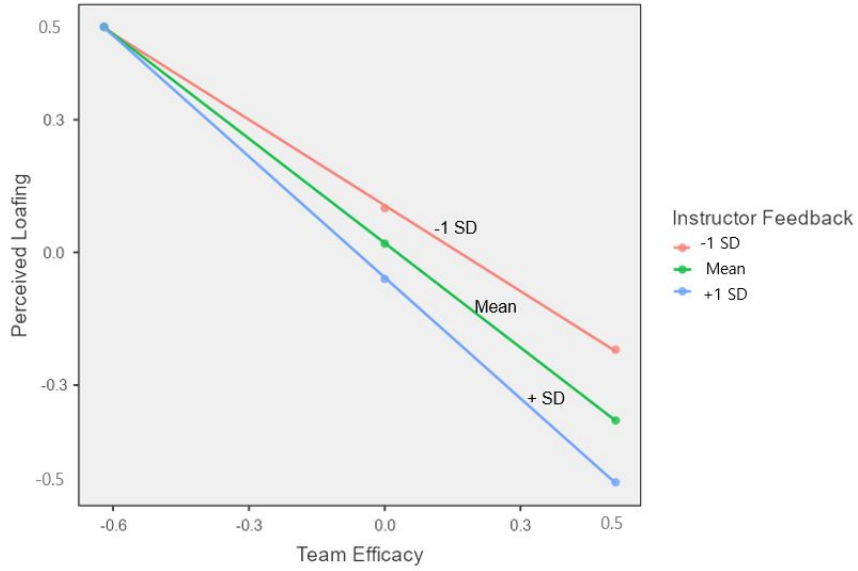


Figure 2. Instructor feedback as a moderator in the relationship between team efficacy and perceived loafing

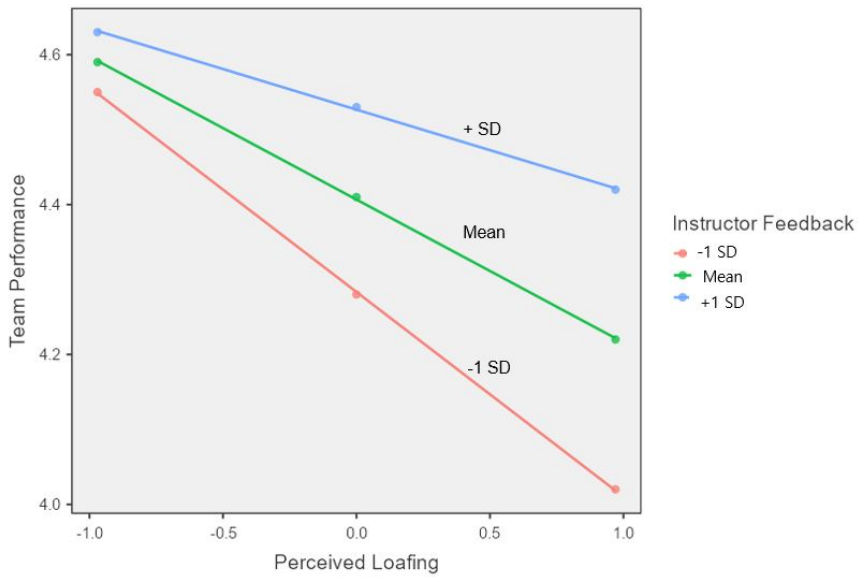


Figure 3. Instructor feedback as a moderator in the relationship between perceived loafing and team performance

The graph was plotted to show the conditional effects of perceived loading at three levels of instructor feedback (Figure 3). It illustrated that team performance generally decreased as perceived loading increased; however, the magnitude of the declining slope significantly differed depending on the level of instructor feedback. As instructor feedback was provided more frequently, the negative effect of perceived loading on team performance was reduced; thus, H3 was supported.

In Table 4, the results of the conditional indirect effect of team efficacy on team performance through perceived loading at three levels of instructor feedback were presented. All conditional indirect effects were significant with a bootstrapping method with confidence intervals. However, H4 is to test whether the indirect effect of team efficacy on team performance through perceived loading was moderated by instructor feedback. The results of pairwise contrasts between conditional indirect effects were not significant, indicating that the indirect effects were not conditional on the moderator. Thus, H4 was not supported.

Discussion and Conclusion

This study aimed to test the effects and the moderating role of instructor feedback in TPjBL. Among the key findings, first, team efficacy was found to have a significant effect in reducing perceived loading and increasing team performance. Additionally, perceived loading negatively impacted team performance and mediated the relationship between team efficacy and team performance. These results are consistent with those of Hasan and Ali (2007) and You (2020) and confirm that team efficacy and perceived loading are critical factors that should be considered for successful TPjBL.

Second, the frequency of instructor feedback was found to be negatively related to perceived loading and moderated the relationship between team efficacy and perceived loading. Specifically, as team efficacy increased, there was a difference in

the perception of loafing between the students who received little instructor feedback and those who received it frequently. High team efficacy, coupled with frequent instructor feedback, noticeably lowered students' perceived loafing. These results confirm that frequent instructor feedback in TPjBL is critical and boosts the suppression of perceived loafing jointly with team efficacy.

Third, despite a high level of perceived loafing, frequent instructor feedback was shown to significantly reduce the damage to team performance. The results showed that when perceived loafing was low, team performance tended to be high, regardless of the level of instructor feedback. However, as perceived loafing increased, the deterioration in team performance significantly differed between the students who received little instructor feedback and those who received extensive feedback. The result signifies the importance of instructors' role in TPjBL.

Lastly, there was a significant indirect effect of team efficacy on team achievement through perceived loafing; however, the indirect effect of team efficacy on team achievement was not moderated by instructor feedback. Thus, although instructor feedback has a moderating direct effect between team efficacy and perceived loafing, and between perceived loafing and team achievement, it does not have a moderating indirect effect.

The study provides some implications. First, the importance of using effective strategies to decrease perceived loafing is highlighted. Although perceived loafing has long been known as the most dominant factor that causes students' frustration in TPjBL, the solutions to reduce social loafing or perceived loafing have been limited. In this respect, this study found that team efficacy and instructor feedback have the potential to reduce the negative effect of perceived loafing. Thus, it contributes to the literature on social loafing and instructor facilitation in student-centered learning.

Second, the importance of team efficacy should be noted. Although the effect of team efficacy on perceived loafing depended on the level of instructor feedback in this study, higher team efficacy tended towards lower perceived loafing, and team efficacy had both direct and indirect positive effects on team performance. Successful

experiences and verbal persuasion are known to be important resources for shaping team efficacy (Huh et al., 2014), therefore, instructors should be aware of how important it is for their TPjBL students to have high team efficacy and successful learning experiences, which are good resources for developing team efficacy.

Third, and most importantly, this study suggests practical implications for the field by empirically demonstrating the role of instructors and the effectiveness of providing feedback in the student-centered and collaborative learning contexts. To demonstrate effective learning-facilitation behavior, instructors must first understand constructivist learning principles and student-centered pedagogy. They must also comprehend the importance of facilitation and how their facilitation relates to students' team project learning experiences and outcomes. They need the ability to monitor team learning and teamwork during TPjBL and provide appropriate feedback to students in a timely manner. However, as reported by some studies (Gillies & Boyle, 2010; Kim & Jang, 2018; Riebe et al., 2016; Ruys et al., 2011), instructors have expressed their lack of ability to design and facilitate student-centered learning and TPjBL. This suggests the need for teaching competency development programs for instructors. Furthermore, institutional-level support is essential for the effective implementation and dissemination of TPjBL. Schools should consider offering instructors with teaching competency development programs for team learning, coordinating small class sizes, and assigning teaching assistants to enable instructors to increase effective feedback and facilitation to students in TPjBL.

This study has several limitations, which suggest avenues for future research. First, given that the data were collected at a single Korean university, these results should be generalized with caution. Conducting more studies on TPjBL in various contexts in the future will help in drawing more robust conclusions. Second, because the degree of feedback was measured by frequency, the quality of feedback was not reflected. Therefore, future studies that measure quality of feedback can contribute to expanding the theoretical and practical implications of instructors' facilitation.

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Appendix A.

Instructor feedback (1 item)

- How often are feedback or consultations provided from instructors during and after the project classes?

Team efficacy (5 items)

- I believe that our team members would contribute to the team project.
- I believe our team has basic teamwork skills.
- I expect our team to work well together in carrying out the team project.
- I expect our team to successfully complete our team project.
- I am confident that our team has the adequate knowledge and skills to carry out the project.

Perceived loafing (4 items)

- Our team members divided the work equally and completed their respective tasks (reversed item).
- Some of our team members worked more than others.
- Some team members took on most of the work.
- I believe that our team members faithfully performed their duties (reversed item).

Team performance (6 items)

- Our team was satisfied with the final project results.
- Our team produced high quality project results.
- The final product of our team project will be evaluated as excellent.
- The team project was carried out in a time-efficient way.
- The team project was carried out by efficiently dividing the work among team members.
- The team project was carried out efficiently in terms of resources, costs, and effort.

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