Say No to Free Riding: Student Perspective on Mechanisms to Reduce Social Loafing in Group Projects

Uthpala Samarakoon[1], Asanthika Imbulpitiya[2] and Kalpani Manathunga[1]
[1]*Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka*
[2]*School of Engineering, Computer and Mathematical Sciences, Auckland University of Technology, New Zealand*

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Abstract: Project based learning is a popular teaching method in Information Technology undergraduate programs where students gain necessary skills and knowledge via a hands-on capstone project. Key learning gains from such projects are problem-solving skills by applying theoretical knowledge while improving soft skills like collaboration and communication. Students can improve critical thinking, learn to face challenging situations, and build creative solutions for a desired problem as a group. Irrespective of all these benefits, social loafing or simply free riding can be recognized as the key challenge in these group-based projects. Some students in group projects put less effort on group work than when they work alone while surviving in the group and taking credits for someone else's work. This scenario leads to demotivation of hard-working members and lot of group conflicts. Ultimately, social loafing affects the group performance while resulting with unsuccessful projects and dissatisfied students. Seeking mechanisms for reducing social loafing in group projects is becoming a vital and this research proposes set of mechanisms to reduce social loafing in IT group projects and presents the students' perspective on usefulness of each mechanism.

1 INTRODUCTION

Project based learning is a main teaching method in undergraduate education regardless of the discipline. This shifts traditional teacher centric education into a student centric education. It's quite a common phenomenon that collaborative learning activities such as Project based learning may leave room for free riders or social loafers if correct scaffolding mechanisms or precautions are not injected to the process. So, reducing social loafing in group projects is challenging. Due to varied reasons like lack of skills and time, difficult curriculum matters, etc. students tend to find shortcuts (i.e., easy ways) to pass modules, rather than acquiring intended knowledge or providing actual contributions. They may consider group project as an opportunity to experience social loafing and this leads to lot of group conflicts and discouragement of hardworking group members. Social loafing has become a regular practice among Information Technology undergraduates too. It is evident that the educators are required to implement specific mechanisms to discourage students willing to practice social loafing in group projects.

According to the common practices in undergraduate Information Technology capstone projects, the students are assigned to groups and each group is assigned a task to achieve within a specific time. Sometimes the groups are formed by the module leader or sometimes students are free to group by themselves. Finally, the group should come up with a collective solution for the assigned problem while asserting their effort and knowledge as a group. This process might support the concepts of social loafing if required scaffolding is not and lacks individual assessments. Hence, this research finds out how social loafing can be reduced in undergraduate capstone projects during an Information Technology undergraduate degree program. The study recommends set of mechanisms to minimize social loafing based on students' and lecturers' perspectives.

As Blumenfeld et al. (1991) stated, project-based learning is engaging students in a real-world problem to identify a solution which is considered as a comprehensive approach to teaching. Many researchers have discussed on using project based leaning to enhance undergraduate education by introducing project based learning into the curriculum in different disciplines like Engineering,

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Environmental and Science education (Kanigolla et al., 2014; Redshaw & Frampton,2014; Bilgin et al.,2015). There are many advantages of project based learning such as creativity, analytical skills and provide opportunities for students to improve soft skills like teamwork, time management and leadership skills. Yet, there are some issues attached to this approach like social loafing being one major issue.

As Bell (2010) stated, project-based learning is an innovative approach to learn critical strategies to succeed and acquire skills needed to survive in the twenty-first century. It directs students towards self-learning through inquiry and encourage them to work collaboratively to create projects that reflect their knowledge. Further, project based learning helps to increase technology skills of students while making them professional communicators and skilled problem solvers.

Social loafing is a behaviour where certain students failing to contribute their fair share of effort when compared to the other students of a group (Aggarwal & O'Brien , 2008). In the past, several researchers had started discussing on possible reasons for social loafing or free riding in group projects. As Synnott (2016) indicated the way of handling group formation, group size and student misconceptions can be some reasons for social loafing among students. Shimazoe & Aldrich (2010) have introduced a three-stage model to incorporate cooperative learning into K-12 school environment. They further discuss on group formation and development, introducing factors for successful group processes and the way these factors correspond with student complaints, instructors' roles and how these roles can best be carried out. Singh et al. (2017) investigated the impact of different types of conflicts in social loafing perceptions within groups/teams.

Moreover, few researchers have introduced different mechanisms to overcome social loafing under different disciplines. Maiden & Perry (2011) conducted a research at a business school in the UK to reduce free riding using six different strategies. Strong & Anderson (1990) suggested fifteen recommendations for reducing free riding by students in academic marketing group projects. With the objective of identifying and reducing free riders in the group, Davies(2009) introduced different recommendations in creating groups, having an ethnic mix of students, managing intrinsic and extrinsic motivation and recognizing the effort. Brooks& Ammons (2003) introduced a group evaluation instrument to mitigate free-rider problems and improve students' perceptions about groups and group projects. Tong et. al (2017) introduced personal devices (tablets) into group work in a computer supported cooperative setup to mitigate free riders. Lam (2015) determined the influence of communication quality and task cohesion on social loafing. Furthermore, the article discusses instructional strategies that foster quality communication to reduce loafing.

However, based on the preliminary exploration of the literature very limited researchers have focused on the social loafing aspect in IT related projects. When the current education system evolves around student centric environment it would be extremely valuable for educators to figure out mechanisms to reduce the social loafing in project-based learning and to achieve expected learning outcomes successfully.

Prior to this work, authors proposed a framework of 12 mechanisms to reduce social loafing in a previously published work-in-progress paper (Samarakoon & Imbulpitiya 2019). This work is matured as a comprehensive follow up research where the framework is implemented in real-class settings to learn the successfulness of the proposed mechanisms. The next sections of the paper reveal the proposed mechanisms (as in Table 1), followed by how those mechanisms are experimented in real student class settings. Then the results section shows an analysis of survey data carried out with undergraduate students and lecturers. Finally, an overall discussion is provided with detailed insights from the study followed by concluding remarks and future research directions.

2 METHODOLOGY

Sri Lanka Institute of Information Technology is a leading degree awarding university in Sri Lanka. The study was conducted with Second year, second semester undergraduate students who follow Information Technology group project at Sri Lanka Institute of Information Technology. Considering the masses in the classes (average 120 to 200 in a batch, per year), social loafing was identified as a critical factor over the years, especially in the group projects. The main intension of this study is to explore the effectiveness of set of mechanisms proposed to reduce social loafing among group members. Moreover, to identify which aspects are the most effective in controlling free riding as per student's perspective.

A student group with 140 students taking Information Technology Project as a module during their second year second semester was selected for

this study. The students were asked to group into 5-8 member groups of their own and find a client for their project as of their interest. Twelve distinct approaches to minimize social loafing were introduced based on the past experiences of social loafing incidents that were identified among group members during previous academic years. Then the approaches were developed to implement those mechanisms and the students were given all the instructions about new evaluation approaches, scaffolding mechanisms around the module that they must follow and task distribution among members at the beginning of the module. Figure 1 shows how students were engaged in completing project activities collaboratively within groups. The selected approaches and scaffolding mechanisms were experimented during one semester period.

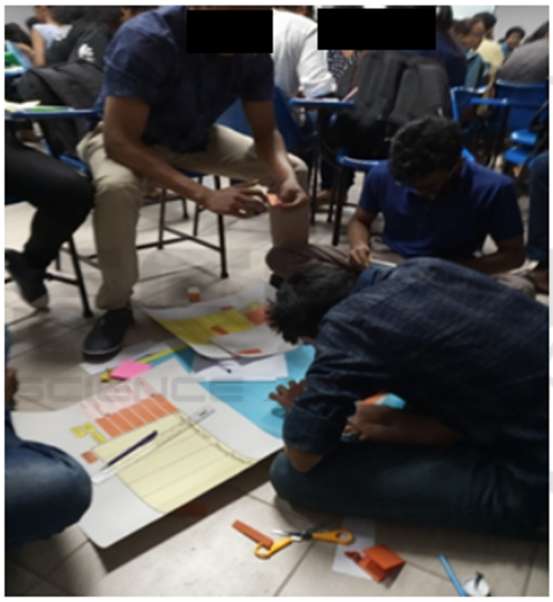


Figure 1: Project groups engaging in group activities.

At the end of the project, a questionnaire was distributed as an optional submission. The questionnaire included five-point Likert scale questions where each participant expressed how much they agree or disagree with a particular mechanism. 50 responses representing 18 project groups were received and used in the analysis. Moreover, lecturer experience was considered also to evaluate the outcomes of these twelve approaches. Table 1 shows the twelve different mechanisms that were experimented for reducing social loafing among members of IT group projects.

Table 1. Twelve mechanisms used to reduce social loafing in IT group project.

No	Mechanism
M1	Allowing students to select members for their group by themselves reduce the ability of free riding
M2	Allowing students to select client/project by the group which interests them more rather than assigned by the lecturer reduce the free riding.
M3	Maintaining a moderate group size (not too large groups) reduce the ability of free riding.
M4	Assign individual functionalities for each member and give whole responsibility of that component reduce the ability of free riding.
M5	Assign similar responsibilities (responsibility of entire unit from design to testing) to all members reduce the ability of free riding.
M6	Assess individual contribution of each member in evaluations reduce the ability of free riding.
M7	Checking overall understanding of each member about the project reduce the ability of free riding.
M8	Conducting individual viva session reduce the ability of free riding.
M9	Checking individual contribution in document preparation reduce the ability of free riding.
M10	Regular group meetings with supervisor and marking attendance reduce the ability of free riding.
M11	Peer review (all students grade the contribution of other members in the group confidentially) reduce the ability of free riding.
M12	Lecturer involvement and supervision in task distribution and group communication when there are conflicts within the group reduce the ability of free riding.

2.1 Implementation of Mechanisms

Allowing Students to Select Members for Their Groups by Themselves. Students were asked to form project groups by themselves rather than assigning groups by the lecturers. The students were given the chance to select members of their interest and the expectation was to allow students to select members with similar interests and values as their peers which may lead to reduction of free riding.

Allowing Students to Select Client/Project by the Group Which Interests Them More Rather than Assigned by the Lecturer. The groups were asked to select the client for their projects by themselves. The intension was to allow students to select a project of their interest, rather than assigning by the lecturer randomly. The expectation was that when students engage in something of their interest as a group, the

members may not try to free-ride and give their fullest support to succeed.

Maintaining a Moderate Group Size. Group size is important when avoiding free riding. Too small groups may increase the frustration of members, since they must be responsible for huge workload of the project. This may lead to free-riding attempts by members. Also, too large groups would support free riding too, since each individual has very small responsibility. Therefore, moderate group size was introduced (5 – 8 members) with the intension of reducing social loafing attempt by students.

Assign Individual Functionalities for Each Member and Give Whole Responsibility of That Component Reduce the Ability of Free Riding. Each member was assigned an individual functionality and the whole responsibility of that section was given to that member. This method makes it difficult for a member to free ride because absence of that component of the project will be clearly visible and the whole responsibility lies with that particular member.

Assign Similar Responsibilities (Responsibility of Entire Unit from Interface Design to Database Connectivity) to All Members. Each member of the group was given similar responsibilities where each member must complete from front-end and to back-end (i.e., designing user interfaces, implement the business logic and database connectivity) of the respective function. In addition to that, every member is required to generate one or more reports related to their function (demonstrating information retrieval aspects).

Assess Individual Contribution of Each Member in Evaluations. The evaluation criterion was designed by focusing individual contribution of each member. The marks were allocated individually in most of the evaluations to mitigate the attempt of free riding. Group members face a series of evaluations throughout the semester (e.g. initial product proposal, prototype stage, final product presentation). Such evaluations are assessed both individually and as a group with more weight to individual contributions in the assessment rubric.

Checking Overall Understanding of Each Member about the Project. In all the evaluations, members were asked questions related to the overall project (e.g. “the main purpose of the product”, “what is the business process”, “different user levels and access privilege for different functionalities of the system”, etc..). The intention was to check their overall understanding about the project apart from their individual component, which might be a good indicator to identify free riders.

Conducting Individual Viva Session. Viva sessions were introduced to measure individual contribution of each member in the group. At the end of the presentation, each member was asked product implementation related questions from their software program to assess whether they have the required technical knowledge that they claim to have in their respective portion allocated for them. The members, who failed to explain most portions with related to their own code, were noted as presenting the work done by someone else after providing several opportunities to explain themselves. Code based questions vary from easy queries such as, “explain the variable in line x”, “what does a particular line-of-code mean” to difficult queries such as “what is the result set returned in this specific API call?” or “how the business logic is implemented in this function”.

Checking Individual Contribution In Document Preparation. Project documentation is equally important in an undergraduate capstone project. Students were asked to mention a sub section explaining the individual contributions of group members when preparing various project documents like project proposal, progress reports, final report etc.. Also, the group leaders were advised to equally assign different content sections of the documents among members.

Arrange Regular Group Meetings with Supervisor and Mark Attendance. The projects groups were asked to meet the supervisor/lecturer in-charge of the project every fortnight and mandated all members to be present at the meetings. The attendance of members was recorded and considered during the final project evaluations.

Peer Review (All Students Grade the Contribution of Other Members in the Group Confidentially). Students were asked to grade their colleagues in the group confidentially. Each student was asked to grade their colleagues in the group based on their contribution to the project and whether they have

completed the tasks assigned to them on time. A Google form was used to gather data related to peer-review. The responses and comments given by peers were used to identify free riders, if any.

Lecturer Involvement and Supervision in Task Distribution and Group Communication When There Are Conflicts within the Group. If any group conflicts were identified during the period of project, lecturers were closely monitoring the group and all the formal communication among group members were done under the guidance and supervision of the lecturer.

All required instructions related to project work and evaluation criteria were given to all the students at the beginning of the project. At the end of the project the students' experience and their perspective on the mechanisms used for reducing free riding were collected via a questionnaire. The students' scores were taken for each mechanism used and scoring was based on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. 50 students answered the questionnaire, and the answers were analysed to get a better understanding about most effective mechanisms according to the student perspective.

Also, number of complaints against the free-riding effect were also logged and compared with the previous years. Finally, lecturers' perspectives and experiences were gathered using interviews and discussion to come up with a final decision.

3 RESULTS

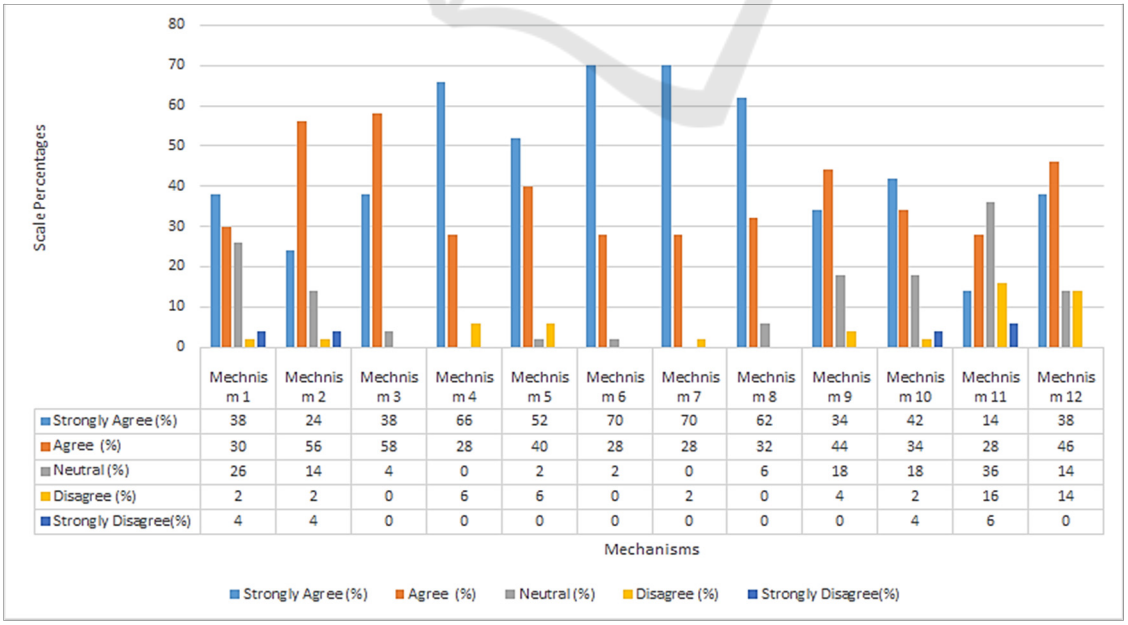
Students' ratings for each mechanism to reduce free riding were analysed to get the overall idea of students' perspective on social loafing and reducing mechanisms. The percentages were calculated for each scale and the collated results are indicated in figure 2.

As per results most of the students (70%) strongly agree that assessing individual contribution of each member in evaluations (M6) and checking overall understanding of each member about the project (M7) helps to reduce social loafing among group members in IT group projects.

Additionally, M4 - assigning individual functionalities for each member and giving whole responsibility of that part (66%) and conducting individual viva sessions, i.e., M8 (60%) are also strongly approved by most of the students as successful mechanisms. Least number of students (14%) identified peer-review (M11) as a successful mechanism for reducing social loafing.

Furthermore, peer-review was rated as the highest strongly disagreed (6%) and disagreed (16%) mechanism among the other mechanisms by the students. The neutral student count (36%) also high for this mechanism.

When considering disagreed student counts, peer-review has the highest count (16%) while Lecturer involvement in supervision in task distribution and group communication when there are conflicts within the group has 14% disagreed student.



	Mechnism 1	Mechnism 2	Mechnism 3	Mechnism 4	Mechnism 5	Mechnism 6	Mechnism 7	Mechnism 8	Mechnism 9	Mechnism 10	Mechnism 11	Mechnism 12
Strongly Agree (%)	38	24	38	66	52	70	70	62	34	42	14	38
Agree (%)	30	56	58	28	40	28	28	32	44	34	28	46
Neutral (%)	26	14	4	0	2	2	0	6	18	18	36	14
Disagree (%)	2	2	0	6	6	0	2	0	4	2	16	14
Strongly Disagree(%)	4	4	0	0	0	0	0	0	0	4	6	0

Figure 2: Student's Perspective on Mechanisms to Reduce Social Loafing.

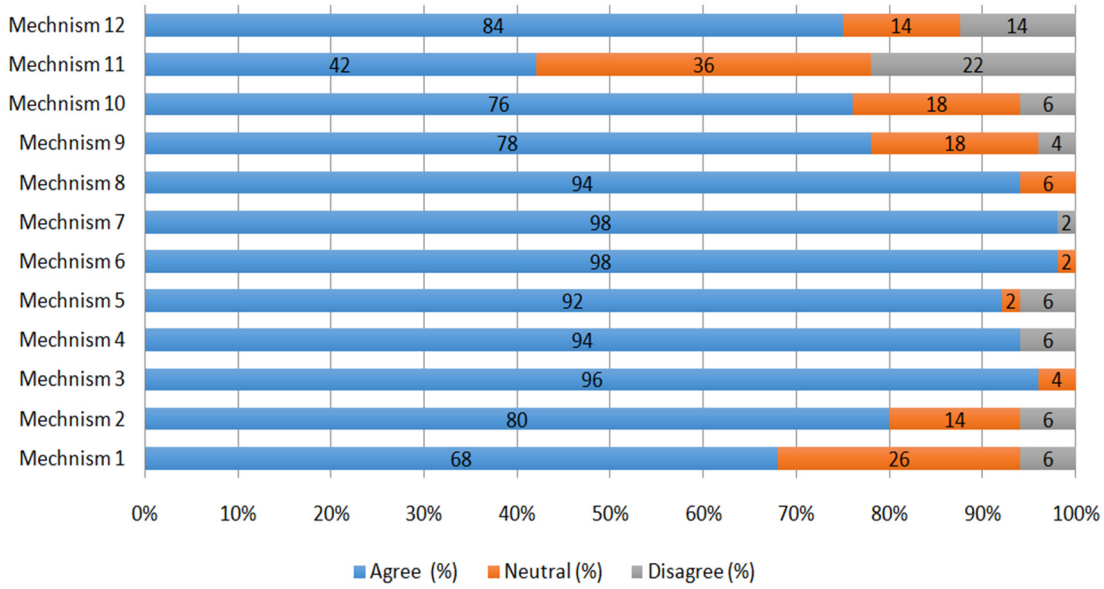


Figure 3: Summarised Student Responses on Approaches.

All the other mechanisms have less than 7% disagree percentage. None of the students strongly disagreed for seven mechanisms out of twelve. Moreover, none of the students disagreed or strongly disagreed for mechanisms like maintaining a moderate group size, assess individual contribution of each member in evaluations and conducting individual viva sessions.

The figure 3 shows the summarized results of students' perspective on approaches used. Here both agreed and strongly agreed responses were concatenated as the students confirming that the proposed approach is successful and same goes for disagree and strongly disagree. Neutral responses were considered separately.

According to the results, both M6 and M7 have the highest (98%) approval by students for reducing social loafing. Then students had selected M3 (96%), M4 and M8 (94%) and M5 (92%) respectively. The next highest agreed approaches are M12 (84%) and M2 (80%). Mechanism 9 and 10 had moderate approval rates as 78% and 76%. Mechanism 1 has considerably low percentage (68%) compared to others. The lowest approval is for mechanism 11 which is 42%.

When considering disagreed percentages, mechanism 11 (22%), and mechanism 12 (14%) have higher disagreed percentages than other approaches. All the other percentages are low than 10%. Out of those M1, M2, M4, M5 and M10 have similar disagreed percentage of 6%. M7 and M9 have low percentages of 2% and 4%. None of the students disagreed for M3, M6, and M8 where the percentage indicated as 0% and is the lowest.

4 DISCUSSION

4.1 Student Perspective on the Impact of Selected Mechanisms

The analysed survey results show that most of the selected mechanisms are successful on reducing free riding in IT capstone group projects according to the students' perspective. The following table (Table 2) shows the impact of selected approaches to reduce social loafing from highest to lowest according to the students' experience in group work. As per students, two approaches were recommended as most effective for reducing social loafing in group projects. Those are assessing individual contribution of each member in evaluations and checking the overall understanding of each member about the project.

All the evaluations were designed in such a way that each member in the group was individually assessed as explained in the above methodology section too. Here each member was evaluated mainly based on their assigned tasks and were individually questioned the way they achieved the desired output. The contributions of each member were analysed, and marks were given accordingly. As per students, this helped to reduce free riding in the project, since the students knew that they would be assessed individually. If the part assigned to them is not

completed for some reason, it is very much visible and that directly affects marks of that particular member.

Table 2: Impact of Approaches to Reduce Social Loafing, as per Student Perspective.

Mechanism	Agreed (%)
Assess individual contribution of each member in evaluations	98%
Checking overall understanding of each member about the project	98%
Maintaining a moderate group size (not too large groups)	96%
Assign individual functionalities for each member and give whole responsibility of that part	94%
Conducting Individual viva session	94%
Assign similar responsibilities (responsibility of entire unit from design to testing) to all members	92%
Lecturer involvement in supervision in task distribution and group communication when there are conflicts within the group	84%
Allowing students to select client/project by the group itself which is interested in them rather than assign by the lecturer	80%
Checking individual contribution in document preparation	78%
Regular group meetings with supervisor and marking attendance	76%
Allowing students to select members for their group by themselves	68%
Peer review (All students grade the contribution of other members in the group confidentially)	42%

Viva sessions was conducted for each member to check their overall understanding of the project. This mechanism was another successful method to identify free riders. Such mechanisms were validated by the students as to cause maximum impact on reducing free riding.

From the remaining mechanisms, students identified another four mechanisms as above 90% impact level. Those are maintaining a moderate group size (not too small or too large groups), assign individual functionalities for each member and give whole responsibility of that part, conducting individual viva session and assign similar responsibilities (responsibility of entire unit from design to implement testing) to all members.

Students assume that maintaining a moderate group size tends to reduce free riding. At the beginning of the IT project the students were asked to make groups of 5 to 8 members on the contrary to the 10-member groups in previous years. The main reason behind this design decision was, when the group size is too high, it allows members to free ride since the individual responsibility is less. On the other hand, very low group size gives very high workload to a single member and it may also lead members to outsource their work. Due to that maintaining a moderate group size was considered as the best way to make all members work equally in the groups without free riding attempts. Each member was assigned with an individual functionality and the whole responsibility of that component was given to that member. This allows students to feel their own responsibility and they are aware that they will be very much visible if they did not complete the part assigned for them. When members have shared responsibilities, some students may try to free ride since they know that someone else will complete their part on behalf of them. Instead, each member should feel the responsibility in the project.

Viva sessions were conducted individually to check individual contribution of each member. Programming related questions were asked from each member to check whether they have actually completed their component by themselves. Also, each member was assigned similar responsibilities from front end to back end. Each member was asked to design interfaces of the functionality assigned to them and internal coding. They were asked to involve in managing the database, handling records related to their functionality. Finally, all of them must involve in system integration and testing. This approach reduces the ability of free riding for a particular member and the free riding attempt become very much visible if occurred. Also, students cannot compare workload of other members and complain about heavy workload, due to equal work distribution. Therefore, assigning similar responsibilities reduced attempts of free riding as per student perspective.

As per students, lecturer involvement in supervision in task distribution and group communication when there are conflicts within the group and allowing students to select client/project by the group itself which is interested in them rather than assign by the lecturer also having a considerable impact (around 80%) on reducing free riding. Lecturers carefully monitored the groups submitted free riding complaints and involved in group communication. The leaders of those groups were asked to copy all the emails to lecturers that they

exchanged among group members regarding task distribution and submission deadlines. So, the free-riding members got to know that they were closely monitored, and that approach helped to reduce attempt of further free riding. Also, members of the groups were given the freedom to select a project from their own rather than assigning by the lecturer. Then the students found projects of their interest and all the members selected their functions through group discussions. This increased the student interest on the project and the responsibility. They all worked hard to deliver the project to their client at the end of the time.

Checking individual contribution in document preparation (78%) and regular group meetings with supervisor and marking attendance (76%) were placed in the average level of impact by the students. All the members in the group were asked to involve in document preparation and they were given the responsibility of an individual section. At the end of each document, students were asked to mention their individual contribution. As students' perspective this helps to reduce free riding to some extent. The reason could be that the document preparation is only a small part of the project. Regular group meetings with supervisor tend to reduce free riding by forcing students to work. Otherwise they cannot explain their progress and contribution to the supervisor at the meetings. Also, marking attendance is another method to reduce this problem. Students who do not participate for most of the meetings can be identified using attendance and lecturers can pay more attention on them.

Allowing students to select members for their groups by themselves was given a low impact (68%) by the students. In the questionnaire some students criticized the approach of allowing students to form their own groups. As the reason they mentioned that smart students group with each other usually and students with average or low skills are remained to group among themselves. As per their perspective, such groups find it difficult to progress with project work and due to that reason students tend to free-ride. Out of all twelve approaches, peer review is given the lowest impact which is 42% by the student. As the reason, the researchers assume that according to the Sri Lankan culture and values, students in a group may not compliant against their friends in a group. Sometimes they may think that it might even lead to group conflicts. So according to them, taking peer review may be not a good method to reduce free riding. This approach might be successful in another country within different cultural values where students show their actual feelings and experience.

4.2 Lecturer Perspective on Free Riding and Reducing Mechanisms

As per lecturers' perspective, free riding is a big problem in group projects. This leads lot of group conflicts as well as makes a discriminating situation for hardworking students. Hardworking students become less motivated and finally it would badly affect for successful completion of the projects. Therefore, as per lecturers, finding proper mechanisms to reduce free riding is very important.

According to the lecturers' experience, the numbers of free riding complaints were reduced after applying the aforementioned mechanisms. They found only two free riding complaints from two groups and those were too under control after close monitoring. Also, they were able to identify free riders as early as possible which gave them the chance to take corrective actions like issuing warnings and close monitoring, etc. As another approach they suggested to not to mix regular students those who take the module for the first time with those who are repeating the module. They have seen that, in most of the situations, repeat students in the group maintain minimal communication and involvement in the work with other members and try to free ride. From past experiences it was identified that, most of the free riding complaints were noticed in these mixed groups. But one student gave an opposite idea on this matter in the survey where he/she suggested not to group only repeating students together. Sometimes most of the members in repeating groups may not work and the hardworking students in those groups may find it difficult to carry out the work. So that approach may have both pros and cons.

5 CONCLUSIONS

Social loafing is recognized as a key problem affecting fair assessments of individuals and successful completion of undergraduate capstone projects. After studying existing literature on handling students' group projects in undergraduate courses in this paper, authors proposed a set of mechanisms to be followed to mitigate social loafing. Moreover, this research reports the experience of adapting these mechanisms to the curriculum of Information Technology Project module. During the experimentation stage, students' perspective was studied further and analyzed which provided some valuable insights to group work from student viewpoint. The overall discussion of the paper

presents the most effective mechanisms for reducing free riding. Furthermore, the lecturer experience and insights were also taken into consideration. The evidence presented showed that most of the proposed mechanisms are positive and successful in reducing free riding among members of IT group projects.

Allowing students to form their own groups and peer review were not much recommended by students. However, these techniques may be successful in a different culture, which could be an interesting factor to explore. Similarly, Sri Lankan students could be exposed to the benefits of peer reviewing and incorporate further mechanisms to make peer reviewing an enjoyable constructive approach in this framework. As future work aligned to this research line, it would be insightful to study further on possible group formation techniques and the impact of those. Constraint-based grouping or using Artificial Intelligent systems to optimize group formation are few areas that could be explored to see if optimized groups would reduce free-riding.

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