

The Efficacy of Peer Assessment on Virtual Collaborative Learning Experiences in Dental Education

Abstract

Disproportionate effort by individuals participating in group projects has the potential to diminish the beneficial lessons derived from working in a team, such as collaborative and leadership skills, conflict resolution, creativity, and more.^{3,7} This dilemma has been further exacerbated by the lack of face-to-face interaction between group members as a result of the sudden transition to virtual learning due to the COVID-19 pandemic. This study builds off of previous research supporting the effectiveness of peer assessment in distinguishing students on extreme ends of the contribution spectrum for group assignments by exploring this phenomenon in a virtual setting.^{4,9} Dental students at the University of the Pacific, Arthur A. Dugoni School of Dentistry evaluated themselves and their peers following multiple collaborative assignments in a course directed by Dr. Parvati Iyer. Individual contributions to each group assignment were assessed by students using an application called Feedback Fruits: Group Member Evaluation which was integrated into the Canvas Learning Management System. The accuracy and effects of the assessments were explored through trends in the amount of time spent on the assignments, measured through the edit tracking feature on Google Docs and Google Slides. Similarly to previous research regarding in-person experiences, the assessments aided in identifying students contributing particularly more or less than their peers. However, the accuracy of the peer assessments decreased over multiple projects. Furthermore, students were not likely to change their level of contribution for future group assignments in response to feedback from prior assignments. Thus, while peer assessment is useful in recognizing disproportionate efforts within group projects, additional steps must be taken to maintain the validity of peer assessment over time and incite behavioral change amongst students.

Background

- > Collaborative learning provides social, academic, and psychological benefits such as social support systems, appreciation of diversity, critical thinking skills, and reduced anxiety as a result of cooperation.^{3,7}
- \succ There is often unequal workload distribution between individuals working on group projects.^{3,5,6}
- > Online group learning experiences have unique challenges compared to in-person group learning, such as differing schedules or individual work pace and lack of face-to-face interaction.² Thus, the sudden increase in virtual learning has complicated the collaborative learning process.
- > Peer assessment aids in identifying students contributing significantly more or less than their peers during in-person group assignments.^{4,9}
- \succ Self and peer assessment have been shown to increase individual student motivation in academic, in-person settings.⁸

Methods

- > IRB approval was obtained in August 2020. All data was collected at the University of the Pacific, Arthur A. Dugoni School of Dentistry.
- > Group projects, or "cases", were assigned in a mandatory 10 week course entitled "Integrated Clinical Sciences: Integrated Case Based Discussions". For the DDS Class of 2022, each of the 3 group projects during the study consisted of a patient presentation, clinical relevance paper, and medical consult/prescription form. For the DDS Class of 2023, each of the 4 group projects during the study consisted of a patient presentation, clinical relevance paper, and concept map. Groups were consistent throughout the research study and the course was virtual.
- Google applications, namely Google Docs and Google Slides, were used to complete the group projects. The edit tracking feature was used to determine the percentage of time individuals spent on the project compared to their entire group during each group project. Time gaps of more than 15 minutes between edits were excluded from the calculated time spent on a project as this length of time increased the likelihood that the
- student had switched to another task rather than working on the group project¹. The DDS Class of 2023 used a Canvas LMS application called "Feedback Fruits: Group Member Evaluation" to rate the contribution of group members for each assignment within a group project on a scale of 0-100%. An individual's received ratings were scaled and averaged to compare to the percentage of time the individual spent on the project. Unpaired T tests were used to compare the mean ratings of students with low, average, and high percentages of time spent on group projects (low percentage defined as at least one SD below the mean, average within one SD of the mean, and high at least one SD above the mean). Paired T tests compared percentages of time spent on the first versus last group project.
- \succ Groups for the study were selected through compliance of the research protocols, primarily the sole use of Google applications to complete the research project in a way that would allow the use of the edit tracking features and consistent use of Feedback Fruits: Group Member Evaluation both within the group and throughout the study. For the DDS Class of 2022, 9 groups were selected for a total of 54 students (26 females, 28 males) participating in the study out of a possible 142 students. For the Class of 2023, 10 groups were selected for a total of 60 students (33 females, 27 males) participating in the study out of a possible 138 students.

A. University of the Pacific Arthur A. Dugoni School of Dentistry	DS 103 Case #1 Clinical Rel
155 Fifth Street	 Medical Issues impacting dental care: Trouble opening their mouths wide, keeping them open in
San Francisco CA 94103	pain/tenderness in the face, neck, ear and/or jaw area (Pa more irritable)
: Fax #:	 Especially if the tmj problems stem from osteoarthritis o increased systemic levels of inflammatory factors
udent Doctor Group FAX#(The side effects of medications that patients take for their considerationie. Some NSAIDs may increase bleeding
aculty Signature Date	 E.g. NSAIDs combined with steroids is contrain Assessment of Clinical data
tient: UOP Chart # Date of Birth	 Patient data "A Class II molar relationship was present, with
agree to the release of my medical information to the University of the Pacific School of Dentistry	 "The patient experienced pain during mandibula masticatory muscle palpation"
atient Signature Date	 Masticatory muscle tenderness possibly "Recurrent headaches, with noise (crepitus) duri
his nationt has the following medical issue(s):	All symptoms of TMD
	 Waximum opening may affect realisting "Lateral tomograms revealed flattening of condules is due to degrade
ranged dental treatments	 Can be indicative of joint degradation Could possibly explain the contact only
ral Surgery	 "A reduced maxillary joint space was present bi position relative to the glenoid fossa"
caling and Curettageestorative Dentistry	• Abnormalities in the TMJ and orientation
oot Canal Therapy ther	 Treatment modifications & Rationale Provide frequent breaks during procedure/ refer out to a
hysician Response:	faster Rationale: fatigue and pain grow exponentially
lease provide any pertinent information	on his orofacial pain lecture) Prolonged or intense force can cause TMD
	 Administer NSAIDs before appointment & prescribe aft Rationale: NSAIDs can reduce inflammatory metabolic
	 procedures Prevent unnecessary lacerations/injury during procedure
heck all that apply: _OK to Proceed. No special precautions or recommendations	 Rationale: Certain medications may increase any more clearching
Precautions and recommendations	 Injury during procedure can increase patient's patients of exercises/stretches/lifestyle changes the
	 Rationale: Bruxism can exacerbate TMD sympto bruxism if stress related -> less pain
_ Antibiotic prophylaxis is required. If Yes, please give reason	 Muscles and ligaments tighten with shorter resti Stretching can help release the tightness
If Yes, will you provide the Rx? YesNo	more flexible
_Do not proceed with treatment. Please give reason	
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Biochemistry	Pathogenesis
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- * The percentage of total time spent on a group project will positively correlate with the mean rating received for a student. Particularly low or high percentages of total time spent on a group project will correspond with students who have particularly low or high mean ratings.
- for students receiving particularly low ratings.
- \star The accuracy of peer assessment in reflecting the percentage of total time spent on a group project will decrease over time.

Feedback Fruits and Google Applications



Member Evaluation

Results

Case 1: Percent Time Spent on Project vs. Mean Rating



Figure 4. Correlation of individual percentage of time spent on group project and mean received assessment rating for Group Project 1 in DDS 2023 students.



Figure 6. Change in correlation between percentage of time spent on project and mean received assessment rating over the course of all group projects

Case 3: Percent Time Spent on Project vs. Mean Rating



Figure 7. Correlation of individual percentage of time spent on group project and mean received assessment rating for Group Project 3 in DDS 2023 students.

DS 103 Case #1 Clinical Relevance



for group projects. DDS 2022 group projects consisted (

Hypotheses

* Over time, the percentage of total time spent on a group project will decrease for students receiving particularly high ratings, and increase



Figure 3. Sample of Google Docs assignment and edit history. Photo has been adjusted to anonymize edit history



gure 5. Correlation of individual percentage of time spent on group project and nean received assessment rating for Group Project 2 in DDS 2023 students.

Impact of Case Progression on Correlation Between Time Spent on Project and Mean Assessment Rating

Case 4: Percent Time Spent on Project vs. Mean Rating



Figure 8. Correlation of individual percentage of time spent on group project an mean received assessment rating for Group Project 4 in DDS 2023 students.

Statistical Comparison of Mean Assessment Ratings For Students Spending Low*, Average,**

Case	Compared Groups	p Value
1	Low vs. Average	0.00020
1	High vs. Average	0.0054
1	Low vs. High	0.00061
2	Low vs. Average	0.00093
2	High vs. Average	0.00036
2	Low vs. High	0.012
3	Low vs. Average	0.26
3	High vs. Average	0.0040
3	Low vs. High	0.0035
4	Low vs. Average	0.83
4	High vs. Average	0.053
4	Low vs. High	0.085

Figure 9. Unpaired T test results (a=0.05) comparing mean ssessment ratings between groups of differing contribution to group projects represented by low, average, or high percentage of time spent on group project.

Low Group was at least 1 SD below mean in percent of time spent on group project **Average Group was within 1 SD of mean in percent of time spent on group project *High Group was at least 1 SD above mean in percent of time spent on group proje

- may be necessary to bring about a significant change in behavior.

2. Ekblaw, Robert. (2017). Effective Use of Group Projects in Online Learning. 10.1007/978-3-319-42070-7_43.

and High*** Percentages of Time on Group Project

Discussion

Statistical Comparison of Percent Time Spent on First vs. Last Project

Subject Group	p Value
DDS 2022	1.0
DDS 2023	1.0
DDS 2023: Low Rated* Students	0.91
DDS 2023: High Rated** Students	0.97

Figure 10. Paired T test results (a=0.05) comparing percentage of time spent on first versus last group project. DDS 2023 participated in peer assessmen while DDS 2022 did not.

Low Rated Students received one or more ratings at least 1 SD below mean rating for case 1 *High Rated Students received one or more ratings at least 1 SE above mean rating for case 1

> Previous research indicates that peer assessment helps in identifying students on extreme ends of the contribution spectrum in group projects.^{4,9} This was supported by our findings in the first 3 group projects that showed a significant difference between the mean ratings received by students who contributed low, average, and high percentages of time to the group project.

> This suggests that peer assessment is just as valuable in virtual learning experiences as in-person learning experiences in regards to identifying students who may be under or over contributing to group assignments.

> The percentage of time spent on the group project by individuals did not significantly change from the first group project to the last group project in the control group (DDS 2022, no peer assessments) or the experimental group (DDS 2023, peer assessments). This was also consistent when evaluating students in the DDS Class of 2023 who received particularly high or low ratings in their peer assessments. > This suggests that despite the ability to identify under or over performing students, peer assessment alone is not likely to motivate a student to modify their contribution. Low contributing students remained low contributing over the course of the four group projects despite receiving feedback that they were not contributing as much as expected. This was the same for over contributing students. Additional motivating factors

 \succ Correlation, measured by R², between mean received rating and percentage of time spent on a group project decreased significantly over the four group projects. This trend is also seen in Figure 9 with the increase in non-significant p values when comparing ratings for students with low, average, and high percentages of time spent on group projects throughout the progression of the study. The number of students submitting ratings equal in value for all group mates increased over time as well.

> This suggests that over time, the reliability of peer assessment to gauge student contribution to a group project decreases. This may be due to lack of motivating factors to convince students to spend time submitting accurate feedback, opting instead to put the same rating for everyone. Also, the absence of behavioral change for under or over contributing students may be demoralizing and devalue peer assessment due to lack of improvement in group dynamics. Alternative motivators, such as points for overall course grade and factors to induce behavioral change in students, should be considered to maintain reliability of peer assessment.

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