

Comparing Team Member Effectiveness in Integrated and Non-Integrated First-year Introductory Design Courses

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Abstract

This research paper looks at whether the formal integration of three required introductory courses across two university colleges improves students' effectiveness as team members working together on a final design project and presentation. A new integration program was implemented for six sections of a Design Thinking course during the Fall 2016 semester, while another six sections of the introductory Design Thinking course were taught without the formal integration. In both classes, a multi-part team project was assigned for the last half of the semester. Teams were periodically asked to rate each team member's performance using the Comprehensive Assessment of Team Member Effectiveness (CATME) tool. By analyzing the results of this peer evaluation in integrated versus non-integrated format of the course, we examine the student contributions and grades in the final project and their correlation. Insights from our analysis indicate that teams in both integrated and non-integrated sections worked well. We also found a correlation between the student contribution and grades in the final project. We investigate the potential for interdisciplinary pedagogy as we continue administering this STEM-Humanities integration program.

Introduction

This research paper looks at whether the formal integration of three required introductory courses across two university colleges improves students' effectiveness as team members working together on a final design project and presentation. This program, the Integrated First-Year Experience, joins a Design Thinking course, an English Composition course, and a Speech communication course, with the goals of improving students' learning, engagement, and sense of community. A more complete description of the Integrated First-Year Experience and related assessment are described more fully in Chesley et al (2016).

Many first-year experience programs with similar goals have been implemented and carefully studied, including learning communities and course integration efforts (Enke, 2011; Smith 2011; Gardner, 2013). Much previous research in this area has focused on integration within STEM disciplines or on limited residential and academic learning communities; reports generally confirm the potential for integrated and interdisciplinary curriculum to improve student learning transfer, academic engagement, and sense of community. Our integration program extends this work, and this analysis describes how student teamwork is affected when multiple courses are formally integrated across disciplines.

Background

First-year undergraduate experience, socially and academically, has been linked to students' future rates of success and engagement (Laux, D. 2014; Chemers, M. M., Hu, L.T., & Garcia, B.F. 2001; Hutchison, M.A., Follman, D.K., Sumpter, M., & Bodner, 2006). In response to such findings, many institutions have attempted to improve retention and persistence among their

student bodies by introducing efforts to improve the first-year experience. Common means of increasing student engagement in the first year of undergraduate education include first-year seminars and other programs, residential or academic learning communities, and course integration (Gardner, 2013; Smith, R. 2011; Wilcox, P., Winn, S., & Fyvie- Gauld, M. 2005; Tinto & Goodsell, 1994; Enke, 2011). These methods of managing and enhancing first-year undergraduate experience have been well-researched and seem generally successful; however, large-scale partnered-teaching efforts that span more than one institutional department are relatively uncommon in the context of large public research universities. At a large public research university, a new Integrated First-Year Experience among 3 introductory freshman courses—Introductory Composition, Fundamentals of Speech Communication, and Design Thinking in Technology, has been implemented. In total, the integration involved over 500 first-year students, 34 instructors, and 3 departments across the university. Large-scale integration on this level is an alternative to traditional university models, where strict discipline-based divisions of coursework are more common.

In this new arrangement, students in each integrated introductory Design Thinking class are also enrolled in either an introductory Communication course or an introductory English course. In each introductory Design Thinking course, there are 40-45 students enrolled; of these, 20-25 are enrolled together in an introductory Communication course, and 20 are enrolled together in an introductory English course. Students enrolled in the integrated version of these courses therefore spend at least twice as much time in classes with a familiar group of peers, which seems to lead to a greater sense of community, based on reflection by course instructors who noticed particularly close-knit groups. Administrators from each department worked to develop initial outlines and structures that would facilitate curricular overlap and connection across each integrated “trio” of classes. Instructors in each “trio” were expected to collaboratively explore and implement effective ways of reinforcing and integrating concepts and curriculum from the course they were paired with in their own courses. The program was implemented for six sections of each course during the Fall 2016 semester. Another six “non-integrated” sections of the introductory Design Thinking course were taught with the same curriculum and projects, but without the formal integration with English and Communication. In both integrated and non-integrated sections of the Design Thinking course, a multi-part team design project was assigned for the last half of the semester. Teams were periodically asked to rate each team member’s performance using the Comprehensive Assessment of Team Member Effectiveness (CATME) tool (Ohland, M.W. 2012).

Repeated use of peer evaluation in similar courses has shown increases in student effectiveness ratings and ratings of other team members, suggesting growing team cohesion. By analyzing the repeated use of peer evaluation in integrated versus non-integrated courses, we examine whether the increased sense of community fostered by the integration has any effect on student peer evaluation responses. We compare student participation rates on the peer evaluation to test whether one setting results in higher levels of contributions than the other. We also compare how effectiveness ratings from peers compare to grades received in two final project assignment assessments- the design journal and the final presentation. Finally, we compare correlations between student contributions and grades in the final project assignments to see if there is a difference between the two conditions.

Our findings will explore what differences emerge when CATME responses are analyzed and compared across sections. We then interpret our findings within the context of the course integration program. CATME raw data from the 12 Fall 2016 (six integrated and six non-integrated) sections for the final design project were collected. This data will contribute to our ongoing assessment and refinement of the integration program overall. Whether applied to integrated courses or traditional courses, these findings may show the impact of improved feelings of community in the classroom for collaborative learning, peer evaluation, and student growth.

Methods: The CATME survey

CATME (The Comprehensive Assessment of Team Member Effectiveness) is a behaviorally anchored peer-rating scale the instructional team used to let student teams evaluate their team members' contributions and describe the various levels of team member performance. CATME was administered multiple times during the final project in the Design Thinking course. For this study, only the team member contribution scores for the final design journal and final team presentation were collected from the surveys. CATME surveys yield numerical data based on the various levels of interaction between team members on a scale of 1 to 5 where high quality interactions receive a score of 5, intermediate interactions receive a 3 and poor interactions receive a 1. The CATME interface asks students to rate themselves and their peers by selecting one of five behavioral descriptions per metric pre-selected by the instructor. These five standard categories in brief are:

1. Contributing to the Team's Work,
2. Interacting with Teammates,
3. Keeping the Team on Track,
4. Expecting Quality,
5. Having Relevant Knowledge Skills and Abilities.

All students in each team evaluate themselves and their peers on a set scale of 1 to 5 points in the five areas mentioned above. The results of the CATME system allow instructors to identify high performing teams and low performing teams and bring attention to the reasons for a team's success. The students also receive a net score that is the average of scores given by their peers. This averaged rating per student results again in values between 1 and 5. Individuals may then use this score to learn how their team members perceive their contributions and to self-evaluate and perhaps modify their contributions later in the project.

Along with the averaged CATME scores per student for these projects, we also used the scores each student received on their team design journal and final presentation in our analysis. These scores are based on a standardized rubric which was commonly used in both the integrated and non-integrated sections. The CATME instrument as initially administered (calibration CATME exercise) allows students to rate fictitious team members before actual CATME surveys are administered. The need for calibration is to explain the results of calibration to students to show how the ratings given to their peers affects each individual student's team score and what this score means to their score on those assignments, where CATME score is used. The CATME calibration exercise also provides an opportunity to discuss the results of a CATME survey and

sets expectations before multiple administrations. Mentzer et al. (2015) recommend that repeated administrations of peer evaluation improve student contributions.

Research Questions

In the current study, we plan to address the following research questions:

1. Is there a difference in grades on the final project design journal (dj) and the final presentation (fp) between the integrated and non-integrated sections?
2. Is there a difference in student contribution on the final project design journal and the final presentation between the integrated and non-integrated sections?
3. Is there a correlation between the individual student contribution and the grade they receive for the design journal and final presentation?

Results

The data collected for Fall 2016 were produced by the individual instructors for the course. All data, CATME scores and grades were received with all individually identifying data removed. The scores for each individual were evaluated based on the students' affiliation with an integrated or non-integrated sections of the Design Thinking course.

1. Grade comparison between Integrated and Non-integrated sections

Through an initial statistical analysis, it was concluded that while the data met the ANOVA assumption of variance they did not meet the assumption of normality in either case, integrated or non-integrated sections for Fall 2016. Due to the assumptions not being met, the data were run in a Kruskal-Wallis test for nonparametric data. A Kruskal-Wallis H test showed that there was a statistically significant difference in Design Journal grade between integrated and non-integrated sections, $\chi^2(1) = 19.825, p < .001$, with a mean rank Design Journal grade of 229.32 for integrated and 287.47 for non-integrated. Likewise, a Kruskal-Wallis H test showed that there was a statistically significant difference in Presentation grade between integrated and non-integrated sections, $\chi^2(1) = 24.043, p < .001$, with a mean rank Presentation grade of 226.31 for integrated and 290.57 for non-integrated. This means that for these data, one would reject the null or rather students' grades on their Design Journals and final Presentations varied between the integrated and non-integrated sections of Fall 2016. Students in non-integrated sections scored higher overall than those in integrated sections. While the statistics cannot show the reasoning behind this, further research utilizing qualitative data is being conducted.

Table 1. Kruskal-Wallis Test

	Design Journal Grade ^a	Presentation Grade ^a
Chi-Squared	19.825	24.043
Df	1	1
Asymp. Sig	.000	.000

^a Grouping Variable: Integrated_Non-integrated

2. Student contribution comparison between Integrated and Non-integrated sections

If contribution is measured as a 1 to 5 score and we looked at all the students in the freshman course and divided them in two groups as integrated and non-integrated sections, the scores were similar. No statistical difference was found in the scores for the two groups. This shows that the hypothesis which we initially proposed that there is more contribution in the integrated sections as compared to non-integrated sections is to be rejected. However, we have qualitative data which we plan to analyze to find differences between integrated and non-integrated section student contributions.

3. Grade-Contribution Correlation

Looking at the two assignments of the final project in the Design Thinking course that were statistically significant between integrated and non-integrated sections, we then measured whether or not the individual student contribution to the assignment was correlated with their individual assignment grade. A Spearman's rank-order correlation was run to determine the relationship between 515 students' Design Journal grades and their individual contribution to the Design Journal as evaluated by their peers utilizing CATME. There was a strong, positive correlation between Design Journal grades and contribution, which was statistically significant ($r_s(513) = .384, p < .001$).

Table 2. Spearman's rho- Design Journals

		Design Journal Contribution
Design Journal Grade	Correlation Coefficient	.384**
	Sig. (2-tailed)	.000
	N	513

** Correlation is significant at the 0.01 level (2-tailed).

The same analysis was run to determine the relationship between 515 students' Presentation grades and their individual contribution to the Presentation. There was a strong, positive correlation between Presentation grades and individual contribution, ($r_s(509) = .526, p < .001$).

Table 3. Spearman's rho- Final Presentation

		Presentation Contribution
Presentation Grade	Correlation Coefficient	.526
	Sig. (2-tailed)	.000
	N	509

** Correlation is significant at the 0.01 level (2-tailed).

Analysis

While the statistical analysis revealed there was no statistically significant difference between integrated and non-integrated sections of the course for the case of student contribution assessed through CATME, this lack of a difference allows the researchers to conclude that teams in both types of sections worked well together. In the integrated sections, teams were based on the topic of the final project as well as a combination of both English and Communications students in hopes for a well-balanced contribution. In the non-integrated sections, teams were solely decided based on the topic of the final project. The analysis shows that based on students' own self and peer evaluations, they felt as though their team worked well across all aspects of the project and that contribution was evenly distributed. While researchers expected to see significantly higher functioning teams in integrated sections due to a diverse team makeup, the functionality across all sections is ideal.

Unlike the CATME contribution scores, the final grades on the design journals and the final presentations showed a statistical significance between integrated and non-integrated sections. The mean rank scores for design journal grades was 229.32 for integrated and 287.47 for non-integrated sections. Presentation grades showed a similar spread in mean ranks. Integrated sections had a mean rank of 226.31 and non-integrated sections had a mean rank of 290.57. These ranks indicated that students in non-integrated sections tended to score higher on both the design journal and final presentation. While the researchers do not currently have conclusive evidence as to why this difference was discovered, they speculate that the instructor expectations vary from integrated to non-integrated. Although the majority of instructors taught at least one integrated and one non-integrated section, they may have graded the integrated section with the expectation that, given close ties with English and Communications, the student work should be more reflective of that connection. Another possibility the researchers want to explore is the sense of community felt by integrated sections and the potential impact that had on their final presentation. Given integration across three courses: English, Communication, and Technology, students in the technology course are familiar with their peers early in the semester. Half of the technology class is paired with an English class with the same peers, the other half is in an identical Communications class. This extra time spent with the same peer group may lend itself to a greater sense of a community.

Although the CATME scores were not statistically significant and the grades for design journals and final presentation were, there was a correlation between the design journal grade and the individual contribution. There is also correlation between the presentation grade and the individual contribution.

The correlation between the design journal grades and the contribution informs us that students who were considered by themselves and their peers to have contributed extensively to the final design journal received a grade higher than that of their peers. Those students who were evaluated by their peers as contributing less to the design journal received a lower grade than their peers. This shows that design journal scores that students received are logically in tune with the individual student's contribution. One of many possible explanations could be that the expectation on students' design journals was not high and more emphasis was placed on the final presentation both by the students and the instructors.

From the statistical analysis of final presentation, the positive correlation between final presentation grades and individual contribution informs us that students perceived by themselves

and their peers to have contributed extensively or poorly to the final presentation received grades in proportion to their contribution.

Conclusions and Future work

There is a correlation between student contribution and the grades students received for their design journal and final presentations. The grades overall are correlating with the self-evaluated contributions of students in both design journal and the final presentation. This means student received expected grade in tune with their contributions. There is not enough proof that the contribution of students in integrated sections is better than in the non-integrated sections. To test if student team effectiveness is greater in the integrated sections, which have a greater sense of community, and to assess how we might better engage the integration program's goals and efforts in combination with peer evaluation, there is a need to look more closely at other factors that may affect students' performance. These factors include the instructors' experience levels in teaching these particular first-year classes and to investigate this, we have planned an extended case study comparison to note differences when the same instructor teaches both integrated and non-integrated sections of the Design Thinking course. Another factor we identified is the expectations students have from their peers in integrated sections may be different from non-integrated sections. We plan to study this effect in a future study. We have also collected qualitative data on the integrated and non-integrated section students in the form of focus groups. We plan to follow up, analyze and see if the integrated students have better reported team experience. We plan to use what we learn from this study and from other research related to the Integrated First-Year Experience to continually refine and improve the program.

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