One small step in the lecture hall, one big step for student motivation: Short bursts of in-class small group work

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Abstract

Great teachers are continually introducing strategies to engage students, especially those who teach large lecture classes, whose format can limit active learning and student motivation to engage in learning. Implementation of active teaching strategies must be assessed for effectiveness. Using the simple MUSIC model post-course assessment survey, student motivation to engage in learning was statistically quantified. A simple short intervention of in-class group work led to significant areas of improvement which included, the student's perception of the class' Usefulness towards their future career ($p<0.01$), their perceived ability for Success in the class ($p<0.01$), their Interest in the material ($p<0.01$), and their perception of the instructor Caring about their success ($p<0.05$). No change was seen in eMpowerment. In addition, students rated the ease of the class ($p<0.01$) and the overall satisfaction with the course ($p<0.01$) significantly higher than the previous semester, prior to the in-class group work implementation. The implementation of this short simple intervention of in-class group work was highly successful in increasing student motivation in a large-lecture, in-major required exercise and health class and can be easily adapted to other large-lecture classes.

Keywords: active learning, motivation, large classes, college/university

Word Count: 183

One small step in the lecture hall, one big step for student motivation: Short bursts of in-class small group work

From the implementation of Kahoots™ (*https://kahoot.it*), to using a Flipped classroom, great teachers are continually refining their pedagogical practices to better engage students and increase their motivation for learning. But are pedagogical practices actually effective in increasing student motivation for learning? Assessment tools are needed to show statistically significant evidence that pedagogical practices are effective.

The MUSIC model framework assesses five constructs for effective course design that increase student motivation: eMpowerment, Usefulness, Success, Interest, and Caring (Jones, 2009). These constructs assess if the students feel empowered (control over their learning environment), if the students feel the content of the class is useful, if the students feel that they can succeed, if the students feel the subject matter is interesting, and if the students feel valued and cared for by the professor (Jones, 2009). Using the validated MUSIC model, an instructor can assess the effectiveness of a pedagogical practice in their course and whether it is effective in increasing student motivation for learning.

Large-lecture classes are known for their struggle with student engagement and motivation (Geske, 1992; Weimer, 2002). Student engagement can be influenced on multiple levels from their behavioral engagement (e.g. level of concentration), to their emotional engagement, to their intellectual engagement, and finally to their agentic engagement (enriching the process of learning) (Reeve, 2012). In addition to varying degrees of engagement, typical student brings varying degrees of both intrinsic and extrinsic motivation to the classroom and at any given time, these motivations can vary (Lowman, 1990). Intrinsic factors include things such as desire to be in class and interact with classmates, and the whether the student is interested and wants to be challenged by the material being studied.

Extrinsic factors include things such as competing to get the highest grade, pleasing the instructor, impressing one's classmates, and achieving the desired GPA (Williams-Pierce, 2011). There are benefits and drawbacks to either type of motivation. However, evidence points to more advantages to intrinsic motivation in terms of fostering student learning and achievement (Lei, 2010). Recent evidence points to student engagement leading to both an increase in motivation and academic success (Reeve & Lee, 2014).

In a typical large-lecture class, such as this one (enrollment of ~130 students), students sit in stadium-type seating with the professor positioned in the front, possibly on a stage, leading to an impersonal atmosphere which limits student engagement and involvement (Geske, 1992). In addition, the sole learning style is a passive one where the professor lectures and there is little time for student discussion/interaction (Wingfield & Black, 2005). Evidence indicates that in some classes, a passive learning environment is less effective than interactive-engagement techniques on test performance (Hake, 1998) and course learning outcomes (Michel, Cater III, & Varela, 2009). Others have shown no difference in class performance, but have indicated that an active learning environment was more useful to their future (Wingfield & Black, 2005) and led to greater student engagement (Haidet, Morgan, O'malley, Moran, & Richards, 2004). When students aren't engaged, research has shown they begin to participate less in the class and feel an increase sense of anonymity (Gibbs, 1992). In addition, students feel large classes give little or no chance to interact with their classmates and discuss the course material (Carbone & Greenberg, 1998).

Fostering an inclusive culture in the classroom is important for students to become motivated to engage in learning. Self-determination theorists believe performance is a function of human motivation, development, and wellness (Deci & Ryan, 2008). Further, social conditions can improve or inhibit intrinsic and extrinsic motivation (Deci & Ryan,

2008). Fostering a positive social culture in the classroom can improve one's motivation (Wentzel & Wigfield, 1998), whereas a classroom culture of alienation and inauthenticity can reduce one's motivation to engage in learning (Ryan & Deci, 2000). iClickers™ (polling device where students anonymously respond to questions their instructor poses in class), TopHat™ (anonymous polling similar to iClickers, but through a smart phone), PackBack™ (online platform where students ask open-ended questions to encourage discussion), etc. are effective techniques for interactive engagement, but can to fail to increase face-to-face student interaction and connection within the classroom.

Increased interaction in the form of problem-based learning has been shown to increase intrinsic motivation for most students (Fukuzawa, Boyd, & Cahn, 2017), as has the implementation of peer-led team learning in a flipped classrooms (Liu, Raker, & Lewis, 2018), both of which are time intensive and can require additional peer-leader support. Instead, could you increase student motivation with just 5-10 min. of intentional short-bursts of student-led small group time in 25 out of 39 class sessions? To answer this question, the implementation of short in-class group work assignments to practice course material, was implemented in an exercise and health large-lecture class. With this relatively simple intervention, the hypothesis was that student motivation to engage in learning would increase compared to a previous semester, where the class was a straight lecture format.

Material and methods

Course description and structure

In this intervention, a large-lecture exercise and health class, at a 4-year University in the United States was used. The exercise and health course is a required core course in the Human Nutrition, Foods, and Exercise (HNFE) major and meets 50 minutes, three times a week (Monday, Wednesday, Friday) over the semester. Students in this class practice

exercise as medicine, learn why exercise is integral to health, how exercise affects the physiology of the body, how to assess one's exercise fitness, and how to prescribe exercise. In the first semester (Fall 2018; semester 1), it was taught as a straight lecture course where knowledge was assessed on four course-work exams and a cumulative final exam, making up 83.4% of the course grade. In addition to exams, students designed an exercise prescription plan and completed 16 hands-on labs outside of class, making up the remaining 16.6% in the class.

Noticing a lack of attendance (especially on Fridays), students commenting that they didn't know anyone in class to form a study group with, and having to curve exam grades due to low performance, the format of the class was re-assessed. In the Spring of 2019 (semester 2), unannounced in-class group work assignments were added. Students self-selected a group of four students on the first day of class. There were 25 group work assignments throughout the semester, with the lowest five scores dropped. Group work was graded as either present and participated (attended class), or did not participate (was absent from class). The group work accounted for 9.7% of their course grade, reducing the exam percentage of the class to 73.2%. Group work questions practiced key course concepts and exam question material. Table 1 shows examples of group work questions administered. Students used notebook paper to record their answers, in which each member present in class, signed their name. The professor and undergraduate teaching assistants circulated in the classroom, answered questions, and collected their papers.

Insert Table 1 here

Participants

In the Fall course (semester 1), there were 113 students enrolled and in the Spring course (semester 2), there were 134 students enrolled. Table 2 gives demographic

information on the participants. Note the low male participation. The HNFE department is ~80% female. On the last class session of the semester, students were informed of an optional survey to complete on student motivation to engage in learning using the online survey platform, Qualtrics (www.Qualtrics.com). The survey was reviewed and approved by the Institutional Review Board (IRB) at Virginia Polytechnic Institute and State University and informed consent was obtained prior to participants completing the study.

Insert Table 2 here

MUSIC Model survey

The MUSIC model of academic motivation (https://www.themusicmodel.com) is a validated survey (Jones, Byrnes, & Jones, 2019; Jones & Skaggs, 2016; Pace, Ham, Poole, & Wahaib, 2016) which identifies five key components on classroom design that can guide instructors to identify areas to improve student motivation within the classroom (Jones, 2009). The five components are eMpowerment, Usefulness, Success, Interest, and Caring (MUSIC). In addition, two questions are asked on the effort and ease of the course. Effort measures the amount of effort students believe they are putting into the course and ease measures the extent to which students perceive the course to be easy. MUSIC model survey questions are listed in Table 3.

Insert Table 3 here

The MUSIC model is based on a Social-Cognitive Theoretical Framework, where the Components (eMpowerment, Usefulness, Success, Interest, and Caring) work together to facilitate the Action of "increased student motivation," thereby increasing the Outcome of "increased student learning" (Jones, 2009). As seen in Table 3, the questions in the eMpowerment section assess whether the student has choices, control, and opportunities. The questions in the Usefulness section assess how the material is related to the student's future

careers, goals, and the real-world. The questions in the Success section assess whether assignments had clear instructions, were manageable, and whether students received authentic feedback. The questions in the Interest section assess whether the instructor was able to make the subject relevant, surprising, and engaging, and whether the student demonstrated enthusiasm in return. The Caring section assesses whether the instructor showed concern for the student, valued their opinions, made accommodations if possible, and whether they fostered an inclusive classroom experience for the students.

Questions asked are coded for one of the five components and the mean score for all questions within each component is reported, plus or minus the standard deviation. Each question was based on a 6-point weighted scale- *Strongly Agree* (6), *Agree* (5), *Somewhat Agree* (4), *Somewhat Disagree* (3), *Disagree* (2), and *Strongly Disagree* (1). In addition, to the student motivation questions, there were two questions on the student's overall perception of the instructor and of the course, also based on a 6-point weighted scale with- *Excellent* (6), *Very Good* (5), *Good* (4), *Poor* (3), *Very Poor* (2), and *Terrible* (1). Permission to use the Music model was given by Dr. Brett Jones at Virginia Polytechnic Institute and State University.

SPOT survey

The Student's Perception Of Teaching (SPOT) survey is the standard survey from the University to centrally gather student feedback on all courses and instruction. It is linked to the student's learning management system, Canvas (Instructure, Salt Lake City, UT). Students are asked to complete the evaluation at the end of the semester for every class they take at the University and reminders to complete it are emailed to them automatically. The questions are primarily the same, although departments and colleges may add a question or two. Instructors have the ability to add questions to this standard survey that all students fill

out. Three questions were added to the end of the SPOT survey in the Spring 2019 (semester 2) to learn about their opinions on the group work, outside of how it affected their motivation for learning in the class. Class time for the SPOT survey was allotted. 113 out of 134 students completed the SPOT survey, an 84% response rate. The additional questions added by the Professor to the SPOT survey were: (1) The group work facilitated an increase in knowledge of the material. (*Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree*). (2) The group work increased my preparation for exams. (*Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree*). And (3) Please add any comments about the group work here. Responses for the first two questions were based on a 6-point weighted scale with Strongly Agree weighted at 6 points and Strongly Disagree weighted at 1 point.

Statistics

Mean scores for all the questions in a category and standard deviations were calculated via the Qualtrics platform (Provo, UT). Statistical significance was determined using an unpaired two-tailed t-test using Prism (GraphPad, San Diego, CA). Significance was set at $p \leq 0.05$.

Results

With the implementation of group work in an exercise and health large-lecture class, there were significant increases in student perceived Usefulness ($P<0.01$), Success ($P<0.01$), Interest ($P<0.01$), and Caring ($P<0.05$) as shown in figure 1. In addition, there were two questions on effort and ease. The group work implementation led to a significant increase in student's perception of the ease of the class ($P<0.01$) as shown in figure 1. There were no significant changes to the effort of the class or the rating of the professor, with the professor's rating still in the Very Good range (and average rating of 5.1 prior to the group work

implementation and an average rating of 5.4 after the group work implementation). In addition, there was a significant increase in student's perception of the course as a whole, after the group work implementation ($P<0.01$) as shown in figure 1.

Insert Figure 1 here

Students were also asked about the group work on the Students Perception Of Teaching (SPOT) evaluations filled out at the end of the course. Student's average rating of whether group work increased their knowledge of the material was a 5.01, or that they Agreed with the statement as shown in figure 2. Student's average rating of whether group work increased their preparation for exams was a 4.67, or that they had a mix of Agreed Somewhat and Agreed as shown in figure 2. Lastly, students were asked if they enjoyed the group work from which they scored an average of 4.83, also indicating they had a mix of Agreed Somewhat and Agreed, also shown in figure 2. Students were also given an opportunity to freely respond with comments about group work. Forty-five student left comments about the group work. There were many positive comments such as, "The group work assignments were great ways for me to apply the material that we learned in class and it helped me retain the information when I went to take the exam" and "It was very helpful to be able to review information by collaborating with others." There were a couple critiques including, that the students wished there was more time to complete assignments, that group work questions and answers were posted on the learning management site to study from later, and that some group members excluded others by working too fast or by not completing any work. There were only two outright negative comments. One stated, "Only liked group work for grade purposes" and the other stated, "The group work for calculations (running/treadmill) was very helpful but for most of the other topics was not that helpful." Overall, the feedback was

very positive from the students, with forty-three comments quantified as either positive or neutral, on the implementation of group work in a large-lecture class.

Insert figure 2 here

Discussion

Teaching a large-lecture course should be seen as a challenge to make the class feel smaller for the students and this can be accomplished by improving upon one's pedagogical repertoire. There are many best practices to increase student motivation for learning, some of which are highlighted by Lynch and Pappas (2017) in a recent review (Lynch & Pappas, 2017). The intervention currently under study, focused on one simple change faculty can make that is quick and saw significant increases in student motivation. With just 5-10 min of short bursts of group work in 25 out of 39 classes, there were significant increases in four out of the five assessed areas of the MUSIC model for student motivation to engage in learning. Increases were seen in the class' Usefulness for their future career, the student's Interest in the class material, their perceived Success in the class, and their perception of the instructor's Caring for the student's well-being and their success in their coursework. Students also perceived the ease of the course was significantly increased and their overall rating of the course significantly increased. There were no significant differences seen in their perception of eMpowerment (control over their learning environment), effort required to be successful in the class, and the overall rating of the instructor.

The efficacy for group work is evident in literature. Suchman and colleagues (2000) in a microbiology course found that small group work initiated an increase in critical thinking and students perceived group work to be beneficial, even if they didn't always enjoy the process (Suchman, Smith, Ahermae, McDowell, & Timpson, 2000). They also suggested for group work to be viewed successfully by students, there must be clearly articulated guidelines

and goals for the group work. The goals for the implementation of group work in this study were clearly outlined in the syllabus, which may have led to the overall successful embrace of the group work with an average rating of 4.83/6.0 indicating their enjoyment of group work as agree or strongly agree. In addition, although students still rated the effort in the course as high, there was a significant increase in the ease of the course (whether they felt the course was easy or hard), which may be the result of increased critical thinking and active learning that the group work demanded in class.

Researchers have demonstrated that active learning sections in STEM (science, technology, engineering, and math) classes have an overall higher final course grade than traditional sections, especially for those students at the bottom of the grade distribution (Deslauriers, Schelew, & Wieman, 2011; Walker, Cotner, Baepler, & Decker, 2008). In addition, research has shown that college students have short attention spans (Bunce, Flens, & Neiles, 2010). By breaking up the traditional lecture with short-bursts of group work involving active learning, students can re-start the attention clock to help them re-engage with the material (Middendorf & Kalish, 1996). Because of the change in weighting of the exams to accommodate for the implementation of group work, course grades cannot be directly compared between the two semesters. However, the significant improvement in four of five areas of student motivation to engage in learning including the Success measure, indicate the student's perceived success in the class increased. By using short bursts of in-class group work time in 25 out of 39 classes, there were many more opportunities to link students with real-world situations they may face in their future careers (see examples of questions in Table 1), which may have led to their higher Usefulness and Interest scores.

Yazedjian and Kolkhorst (2007) demonstrated group work deepened understanding of material and group activities should be reoccurring so students build relationships with

one another (Yazedjian & Kolkhorst, 2007). One of the outcome goals for the implementation of group work was to foster a more inclusive and welcoming environment, especially for students who did not know anyone. Getting to work with one's peers in a small group, has been shown to be an opportunity to share ideas, knowledge, and experiences in a mutually beneficial setting (Boud, Cohen, & Sampson, 2013). The significantly increased score on the Caring measure, showed students highly perceived that the professor cared for them and for their success in the class. This caring could also have been increased not just directly by the professor, but also in the learning environment the professor facilitated.

To have a successful classroom learning environment, students need to attend and actively participate. Unless there are points for attendance in large lecture classes, it is easy for a student to feel anonymous and then not attend regularly (Chenneville & Jordan, 2008). Although not empirically measured, the observation of students in attendance, especially on Fridays, prior to the group work implementation was low. Again, this could be reflected in their student motivation to engage in learning scores, where their Interest score was the lowest of all five measurements at a 4.1 (somewhat agree). With the implementation of group work, attendance increased dramatically, with only seven students out of 132 not receiving full credit on the group work portion of their final grade. Deslauriers and colleagues (2011) saw a similar effect on attendance in a second-semester physics course with the implementation of active learning techniques that led to an increase in attendance compared to the traditional course section (Deslauriers et al., 2011).

At larger universities, large lecture classes will be forever present, but opportunities to make them feel smaller, forever abound. Recent evidence shows different classroom sizes facilitate different aspects of learning. Bolden and colleagues (2019) showed location matters when delivering the same material to two groups of students, one in a smaller classroom and

one in a large lecture hall (Bolden, Oestreich, & Kenney, 2019). Students in the smaller classroom scored themselves higher in meaningful processing and active participation, which includes engaging with the readings, writings, discussions, or creating and problem solving (Starmer, Duquette, & Howard, 2015). Students in the larger classroom scored themselves higher in a better overall understanding of the material including having more focused attention, a deeper processing of material, and more advanced learning. Can you have it both ways? Can you have the austere academic ambience of a traditional lecture hall, but increased active participation? Yes you can, with intentional engagement techniques such as short bursts on in-class group work.

Limitations

This study is limited by several factors. First it is an observational cross-sectional study. Therefore, one cannot conclude the implementation of group work directly caused an increase student motivation to engage in learning. Other factors could have increased their motivation, including a change to the point structure of the class, or the fact that the professor was more experienced in teaching the material. Given that students also rated the group work as "increasing their knowledge" (a score of 5.01, or Agreed) and "increasing their preparation for exams" (4.67, or a mix of Agreed Somewhat and Agreed), the present study shows a strong association between the implementation of group work and their student motivation to engage in learning scores.

Due to the nature of having a voluntary survey without class points or extra credit, the response rate was low. This could introduce some non-response bias, where the motivation of those students who filled out the survey could be different than the motivation of those students who didn't fill out the survey. However, 84% of students filled out the class evaluation (SPOT) survey, where students favored the group work and of the 45 comments

on group work, there were only two outright negative comments. In future studies, offering an incentive to complete the survey could limit the non-response bias present in this study.

Conclusions

This investigation is the first to use the MUSIC model to assess the implementation of group work in an exercise and health class on student motivation to engage in learning. The implementation of short bursts of in-class group work was successful in increasing student motivation in four out of five areas including: Usefulness, Success, Interest, and Caring, as well as ease of the class. The small group work was positively received by students and it met its aims of increasing attendance, fostering interaction with students, and practicing exam material in class. One small step in the lecture hall made one big step for student motivation! This somewhat small intervention is easy to implement in any large lecture class and would be useful for any discipline to promote active learning and increase student motivation to engage in learning.

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Tables and Figures

Table 1

Examples of group work questions administered in the Spring semester class of 2019 (semester 2).

Examples of 5 of the 25 Group Work Questions asked in class:
1. Starting with an action potential (AP) traveling down the motor neuron, list each step in the process, ending with actin and myosin forming a cross-bridge.
2. Lisa is 35 with a resting HR of 60 BPM. She is 250 lb and is 5'4". Her BP is 140/85 and her LDL-C is 195 mg/dL. a. What is her BMI? What category does she fall into? b. Can you diagnose Lisa as obese, having the metabolic syndrome, and/or having dyslipidemia? c. What is a statin and is Lisa eligible for a statin? d. Using the "exercise prescription" slides design an aerobic exercise program based on her heart rate reserve (HRR) for 1 week. e. Use FITT- frequency, intensity (state the actual HR range), time, and type to describe the aerobic exercise prescription.
3. Determine the ATP yield from a 24-carbon fatty acid. a. How many acetyl CoAs are made? b. How many cycles of beta oxidation occur? c. What is the total NET yield?
4. Choose either: Stroke, Multiple Sclerosis, or Parkinson's Disease. a. Choose the severity of the disease. b. Design an exercise prescription using FITT and taking into consideration the "exercise prescription considerations" from the lecture.
5. Josh was running to catch the bus. a. Given the information below, calculate his Cardiac Output (CO) in L/min: i. End Systolic Volume (ESV) is 60 ml ii. End Diastolic Volume (EDV) is 160 ml iii. Heart Rate (HR) is 120 BPM b. What factors led to Josh's increase in CO? i. List as many as you can think of: Stroke volume factors, EDV factors, ESV factors, HR factors.

Table 2

Demographic information for the student participants.

Semester	Total n Enrolled	Total n Participated (%)	Male/ Female	1st years	2nd years	3rd years	4th years
Fall 2018	113	35 (31%)	3/ 31	1	6	19	8
Spring 2019	134	38 (28%)	8/ 20	2	10	9	7

Note. Not all students that completed the survey provided demographic information.

Table 3

MUSIC model Survey Questions

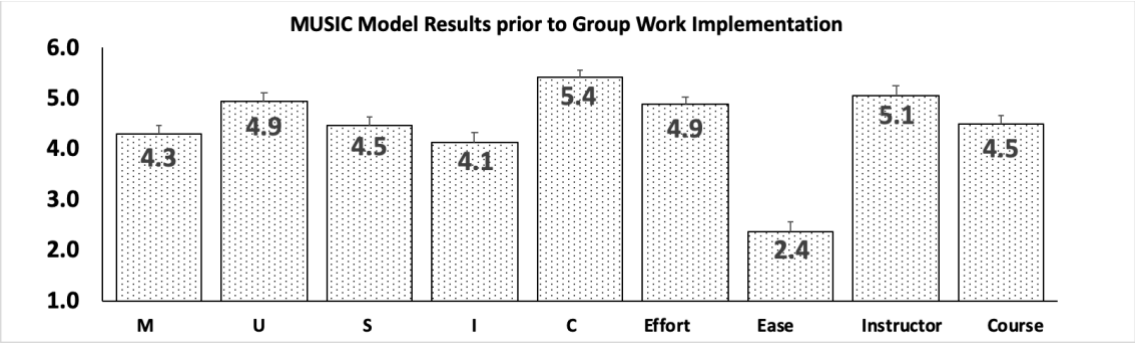
eMpowerment:
I have the opportunity to decide for myself how to meet the course goals.
I have the freedom to complete the coursework my own way.
I have options in how to achieve the goals of the course.
I have control over how I learn the course content.
I have flexibility in what I am allowed to do in this course.
Useful:
In general, the coursework is useful to me.
The coursework is beneficial to me.
I find the coursework to be relevant to my future.
I will be able to use the knowledge I gain in this course.
The knowledge I gain in this course is important for my future.
Success:
I am confident that I can succeed in the coursework.
I feel that I can be successful in meeting the academic challenges in this course.
I am capable of getting a high grade in this course.
Throughout the course, I have felt that I could be successful on the coursework.
Interesting:
The coursework holds my attention.
The instructional methods used in this course hold my attention.
I enjoy the instructional methods used in this course.
The instructional methods engage me in the course.
I enjoy completing the coursework.
The coursework is interesting to me.
Caring:
The instructor is available to answer my questions about the coursework.
The instructor is willing to assist me if I needed help in the course.
The instructor cares about how well I do in this course.
The instructor is respectful of me.
The instructor is friendly.
I believe that the instructor cares about my feelings.
Effort:
I do the best work I can do in this course.
I try my hardest to do very well in this course.

In this course, I put forth my maximum effort.
I do as much as I can do to learn the material in this course.
Ease:
This course is very easy for me.
I don't need to work my hardest to get a high grade in this course.
In this course, I can get the grade I want with very little effort.

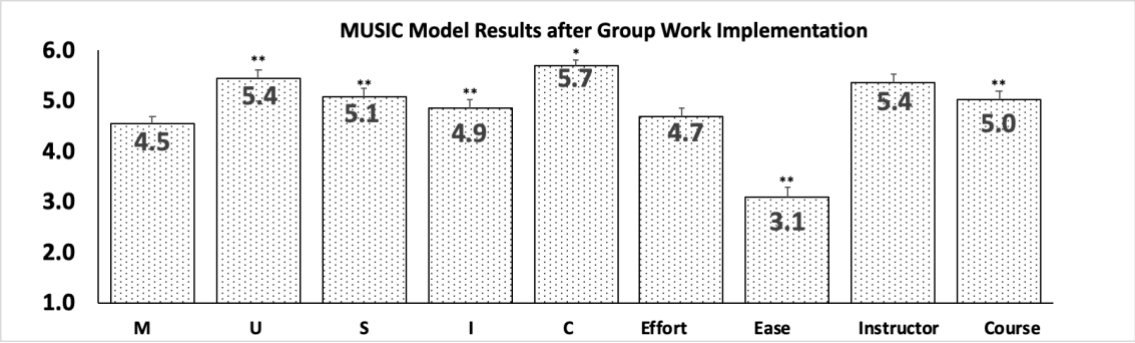
Figure 1

MUSIC Model Survey results.

A.



B.



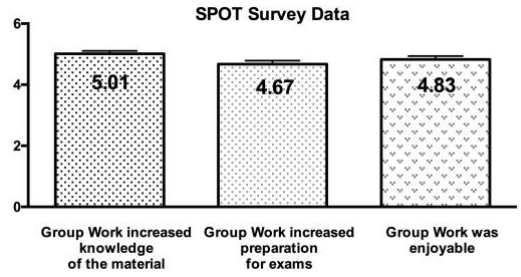
Note. A. Mean scores on student motivation prior to the addition of small group work. B. Mean scores on student motivation after the addition of small group work. Each category of the MUSIC model was scored on a 6-point Likert scale with *Strongly Agree* (6), *Agree* (5), *Somewhat Agree* (4), *Somewhat Disagree* (3), *Disagree* (2), and *Strongly Disagree* (1), where M stands for eMpowerment, U for usefulness, S for success, I for interest, and C for caring. The instructor and course were also based on a 6-point weighted scale with- *Excellent* (6),

Very Good (5), *Good* (4), *Poor* (3), *Very Poor* (2), and *Terrible* (1). Data is presented with the mean score plus SEM bars. Statistics were calculated on total points and standard deviations for all of the questions in a category, but are displayed graphically as means of the questions within a category.

*p≤0.05. **p≤0.01.

Figure 2

Student's Perception Of Teaching (SPOT) survey results for small group work.



Note. Each question was scored on a 6-point Likert scale with *Strongly Agree* (6), *Agree* (5), *Somewhat Agree* (4), *Somewhat Disagree* (3), *Disagree* (2), and *Strongly Disagree* (1).