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Leveraging Incentives, Disincentives, and Peer Feedback to Enhance Student Performance

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Leveraging Incentives, Disincentives, and Peer Feedback to Enhance Student Performance

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Abstract

This research explores the strengths and weaknesses of various forms of student incentives in performance and the impact of peer feedback. New faculty members often struggle to determine the best way to motivate their students to succeed in the classroom. This work specifically considers the various advantages and disadvantages that incentives and disincentives present for student performance. The authors then consider the influence of peer feedback as an additional area of focus to drive positive change in student learning. After reviewing the best practices from different organizations, specific methods are recommended to faculty at the United States Military Academy (USMA). USMA faculty is comprised of a unique blend of active-duty Army officers and civilian instructors. While there are a select number of permanent faculty, the majority are rotational instructors who serve 2-3 years after obtaining a graduate level degree. The cadets at USMA also have unique academic requirements that incorporate physical, military, character, and leader development. These recommendations are meant to guide new faculty at USMA as they navigate the complex requirements of cadet education and the best techniques to elevate student learning. The study examines the impact of incentive-based programs such as extra credit can positively increase student performance if structured correctly by the professor. It additionally considers the effect of ranked-scale grading on student performance and finds that it improves results for high-performing students while not affecting those with moderate or low performance. Lastly the study considers the ability to enhance student performance by applying regular peer feedback in group work.

Introduction

First-time instructors have many tasks and workload to manage before entering the classroom for their first lesson. As recent first-time instructors, the authors have experienced pressure to deliver course material concisely and clearly and maximize the performance of classroom students. Over the past two years, the authors have developed, explored, and researched some takeaways to help first-time faculty maximize their student's potential without being overburdened with additional tasks. The authors believe there is value in minor incentives and disincentives along with the addition of peer feedback that will support the shaping of the student's performance in a course. Following these simple steps should relieve some stress in the classroom and give support for implementing these ideas into the classroom.

Incentives

Extra credit in academic settings is a hot topic depending on what side of the institution you reside. For instructors, it can be hotly debated on the practical use for increasing learning

while others will debate the grade inflation aspect [1, p. 27]. As for students, a much more optimistic view of the concept is more widely accepted since extra credit works in the benefit of those partaking. In the existing literature, there is no universal positive or negative opinion on extra credit in the classroom as the practice is mostly left up to the individual instructor. Whether the practice remains in a contested environment or not, the use of extra credit can have positive impacts in learning. For this research, solidifying the concept of extra credit as a practice to increase understanding and learning in a student is the primary goal and should always be the reason extra credit is created and offered.

Extra credit can take many forms depending on the discipline of study and the type of instructor offering the assignment. Some examples of extra credit are intended to increase student attendance in class, but for this research it is assumed that class attendance and participation are not the main reason for offering extra credit. One focus with extra credit is the structure and content of the assignment offered to students. An example is using pop-quizzes to test a student's attention in lectures, preparation for the current lesson, or understanding of the course material without the anxiety of a graded quiz [2, p. 37]. Standard quizzes established in the syllabus can be met with anxiety and cause students to underperform due to the added stress. With an extra credit pop quiz, students can demonstrate an increased understanding of the course material without this added anxiety that is present during the standard quiz. Moreover, the concepts covered in an extra-credit pop-quiz can be outside the typical structure of quizzes offered since the quiz does not pose any threat to their grade in the course.

Additional assignments outside of scheduled class time is another option for extra credit; however, student opinion and completion of these assignments are extremely low [3, p 14.]. If the purpose of extra credit is to increase understanding in the course material, then this approach of additional assignments outside of the classroom does not meet that intent because participation is so low. Another extra credit approach offered outside the classroom is attending unique events around the campus that tie into the course. Students should be expected to write about these events in an academic format to establish a structure for the assignment. These extracurricular events can open students up to clubs, guest speakers, and films that they may not have otherwise attended which could spark additional learning or interests [4]. Nevertheless, unique events can expand a student's perspective of the topics taught in the classroom. Regardless of whether you are for or against extra credit, the structure and content of extra credit should not be created haphazardly and should follow a process of increasing understanding or engagement in the material by all students.

Point allocation for extra credit is not discussed widely amongst previous studies. One approach to allocating points fairly is taking surprise quizzes leading up to a major quiz or test and adding a percentage of the points earned from extra credit quizzes to the standard quiz [2, p. 39]. Points earned in these surprise tests did not drastically change the score in the standard quiz but the intent of increasing understanding for the students was the major objective when offering these surprise quizzes. Moreover, students scored higher in the surprise extra credit quizzes when compared to the scheduled quizzes and that may have been due to the lack of anxiety that extra credit quizzes provide [2, p. 41]. The purpose of extra credit should not be to inflate grades. Offering students more opportunities to demonstrate their understanding in a stress-free way is

the real purpose of extra credit and should always be followed when structuring these assignments.

Disincentives

The authors then examined the impact of disincentives on student performance. Overall, the disincentives related to student attendance, automatic grading of exams, and rank-order grading in overall course grade. If used properly, disincentives can have a significant impact on student performance.

Much literature discusses the relationship between student attendance and overall performance. The authors first examined a study that looked specifically at the impact that a mandatory attendance policy has on a student's final exam performance in a course [5, p. 47]. In the study, the school's policy is that if students do not attend 75% of class meetings, they cannot sit for the final exam, preventing them from receiving credit for the course. It analyzed whether students comply with class attendance policies and whether their attendance impacted their final exam results [5, p. 48]. The study analyzed the historical attendance and grade data for four undergraduate respiratory care courses at the Almaarefa Colleges for Science & Technology over one semester. The average attendance percentage, accounting for lecture attendance throughout the semester, was then compared to the average student performance on the final exam. It found a positive correlation between average attendance and final exam performance, although there was no statistically significant relationship between the variables [5, p. 48]. It also finds that student performance is improved through a mandatory attendance policy, with a clear disincentive to frequent absences being a lower grade in the course.

While a mandatory attendance policy is a worthy disincentive to student performance, the authors next investigated the relationship between optional attendance and overall course grade through David Romer's study [6]. To establish a baseline for the study, Romer examined the number of students attending one class session for every undergraduate economics class during one week in the spring semester at three schools, all in the upper echelon of American colleges and universities. After analyzing the data, he found that approximately one third of students in economic classes do not attend class [6, p. 168]. The study also finds that absenteeism is higher in core courses and that quality of instruction naturally impacts a students' desire to attend class [6, p. 169]. Using that as his initial launch point, he then examined the effects of attendance on overall performance. He collected attendance for six meetings of his large intermediate macroeconomics course and used that data to analyze the relationship between attendance and performance. In performing this study, he found a strong correlation between attendance rates and course performance. A student who attended 25% of his required lectures earned a C- in the course, while a student who attended all the lectures earned a B+ [6, p. 171]. This indicates that being absent from class is a meaningful disincentive to student performance.

In addition to attendance, the way in which graded events are evaluated can also serve as a disincentive to student performance. In today's digital environment, where immediate feedback is expected in most disciplines, academia naturally seeks to provide immediate feedback through the automatic grading of exams. While there are many benefits to this approach to instant

feedback, including increased access through online programs and the ability to facilitate a larger group [7, p. 5], the authors are more interested in the potential negative impacts of automatic grading. The most significant downside to automatic grading is that students may be able to pass an exam without understanding the underlying concepts [7, p. 5]. Students may prepare only based on previous exams, which lets them perform well but without understanding the material. Additionally, automated exams cannot provide individual feedback [7, p. 5], which some students need to develop their expertise.

Finally, the authors examined a study on rank-order grading to determine whether classroom competition can serve as a disincentive to student performance. The study hypothesized that rank-order grading might lead to better student results [8, p. 12]. To test this hypothesis, they examined data from four sections of a Principles of Macroeconomics course taught during a summer semester at a medium-sized public university. Two sections were graded using a ten-point scale and two sections were graded using rank-order [8, p. 13]. In the rank-order grading sections, each student was assigned a grade according to the percentage of students they outperformed; for example, if a student outperformed 90% of the group, they received an A, or if a student outperformed 75% of the group, they received a C [8, p. 13]. After analyzing the results, the study found that more rank-order graded students received higher scores, while there was negligible impact on scores for lower-performing students [8, p. 14-15]. The study also finds that rank-order grading may be best suited for large-enrollment core courses where there are few group assignments. While competition is its most important quality, critics of rank-order grading argue that this competition has the potential to harm the educational process [8, p. 17].

Peer Feedback

It is widely believed that effective feedback is a positive driver for improvements in student learning outcomes. Feedback comes with a variety of definitions, but in this context the authors establish that it is "any response regarding a student's performance or behavior," and can be verbal, written, or gestural [9]. However, the methods, means, and timing of how to best implement feedback in an academic environment vary. This section will focus specifically on the benefits of peer feedback and how to best implement the practice within the classroom.

Significant benefits exist for students in implementing effective peer feedback, although there are important distinctions to be cognizant of as the instructor. For peer feedback to be effective, students must focus and direct their feedback towards the task rather than the individual [10, p. 3]. A possible 'Clean Feedback Model' is suggested to keep feedback removed from emotional reactions, recognize the bias of the source and recipient, and offer guidelines on how to make the feedback specific and behavior based [11, p. 953]. Additionally for peer feedback to work well, students must feel that they are operating within a trusted environment, open to receiving constructive criticism, have an adequate grasp of the material, and receive feedback with appropriate timing [12, pp. 119-120].

Another important aspect of peer feedback is in effectively managing the procedure and timing, with the goal of aligning peer feedback with expert or instructor feedback [13, pp. 400-401. By synchronizing peer and expert feedback, the resulting assessment becomes more

formative and decreases the importance of the final assessment, which leads to more effective learning outcomes for students as assessment and learning go hand in hand [14, pp. 1-2]. One overlooked aspect of peer feedback is the enhanced learning benefit that it provides the individual providing the feedback. The feedback giver may benefit more than from simply receiving feedback, although students with lesser ability may benefit more than students with greater ability [14, pp. 30-31]. With the benefits of peer feedback introduced, it is now appropriate to explore the methods of implementation.

There are many ways to incorporate peer feedback in the learning process. One study found that leveraging online means of peer feedback was more effective than in-person, as it was a less threatening environment for participants who may have found comfort in an anonymous setting. Some may worry about the loss of community or transparency in the peer feedback process, but the advantages of increased student participation and comfort outweigh the disadvantages. [15, pp. 32-33]. Additionally, peer feedback that linked to specific concrete examples within the text enhanced student learning more than those that did not [16, p. 1814].

Recommendations for Faculty

If an instructor wants to incorporate extra credit into their course, then they should follow three simple rules. First, structure the extra credit so that every student can participate. Whether you want to do pop quizzes or outside of the classroom activities, you need to make it eligible for all students to partake. Second, the content of the extra credit should link back to the learning objectives outlined in the syllabus. Extra credit for attendance is not extra credit and should not be used. Diving deeper into subject material, or even exploring opportunities to involve students in extra-curricular activities can be beneficial to overall learning. Third, cap points available for extra credit amount to no more than 1-2% of the total points offered on the course. By creating a cap of 1-2%, this will prevent students from moving from a solid B to B+ in the course; however, it will provide those students that are close to the next higher grade an opportunity to earn it. Following these three steps can make extra credit fair, relevant, and opportunistic for students in any course.

Faculty members should be aware of the power of disincentives in improving student performance. While the United States Military Academy has a strict mandatory attendance policy, it may be appropriate for more schools to adopt a similar policy to improve student performance. Attendance metrics may also be used to evaluate instructor performance, as there appears to be a relationship between the quality of instruction and the overall attendance. In terms of online tools available, it is essential for faculty members to understand the impact that automatic grading has on student progress. While it provides rapid feedback, it may also limit a student's ability to think critically and fully absorb the material. Therefore, automatic grading may be best employed during daily reading quizzes or periodic checks on learning but not during final examinations. Also, course grade policies may significantly impact student performance. Rank-order grading, where a student is graded based on the percentage of other students they outperform, may encourage high-performing students to excel. In an ultra-competitive classroom environment, this may help instructors identify the true high performers. A hybrid approach may

be most impactful, with some events graded on a traditional scale and others graded using rank-order grading.

The power of peer feedback is well documented in literature and faculty would be wise to regularly incorporate it as part of their curriculum. First, faculty should emphasize the importance of systematic feedback and provide structure to the process, much like the 'Clean Feedback Model' discussed earlier. Leveraging anonymous online peer feedback will also increase comfort for the feedback provider and feel much less threatening than doing so in person, while also improving overall participation in the process. Typically, associating completion of the feedback with a minor portion of any assignment grade (e.g., 5%) provides enough motivation for students to follow through. One freely available tool for any faculty to utilize is the TEAMMATES peer evaluation tool, available at https://teammatesv4.appspot.com/web/front/home. The TEAMMATES tool allows for faculty to easily assign, group, anonymize, collect, and assess the data from a customized list of available feedback questions.

Future Work

A future research effort is planned to quantitatively assess the impacts of incentives, disincentives, and feedback in one study involving students. The research is being conducted with a large enough sample size of different sections of students within the same course and limits the number of faculty involved in teaching to reduce confounding variables in the study. The TEAMMATES tool provides the primary data collection at various points throughout the course (e.g., after an assignment, or incentive/disincentive event) to capture its impact on student performance. Other data will be collected through simple surveys Microsoft Forms at the appropriate times. Adequately sized control and test groups are used. For example, if one instructor teaches four sections of the same course; they will use two sections as a control group and two sections as a test group. When assessing the data, one must account for and control many variables that would otherwise impact student performance, like their GPA entering the course. Before publishing any study involving students and data collection, the research would need to be approved through an Institutional Review Board (IRB), which is currently pending.

References

[1] J. L. Groves, "Students' Perceptions of Extra Credit," Journal of Hospitality & Tourism Education, vol. 12, no. 1, pp. 27–62, Jan. 2000, doi: 10.1080/10963758.2000.10685265.

[2] M. Muztaba Fuad and E. J. Jones, "Using Extra Credit to Facilitate Extra Learning in Students," International Journal of Modern Education and Computer Science, vol. 4, no. 6, pp. 35–42, Jun. 2012, doi: 10.5815/ijmecs.2012.06.05.

[3] R. Moore, "Who Does Extra-Credit Work in Introductory Science Courses?" Journal of College Science Teaching, pp. 12–15, Jul. 2005.

[4] D. Cohan, "Extra, Extra, Read All About It! | Psychology Today," www.psychologytoday.com. https://www.psychologytoday.com/us/blog/social-lights/201801/extra-extra-read-all-about-it (accessed Jan. 27, 2023).

[5] T. Fadelelmoula, "The Impact of Class Attendance on Student Performance," *International Research Journal of Medicine and Medical Sciences*, vol. 6(2), pp. 47-49, May 2018, ISSN: 2534-211X.

[6] D. Romer, "Do Students Go to Class? Should They?", *Journal of Economic Perspectives*, vol. 7(3), Summer 1993, pp. 167-174.

[7] M.G. Hahn, S. M. Baldiris Navarro, and D. Burgos, "A Systematic Review of the Effects of Automatic Scoring and Automatic Feedback in Educational Settings," *IEEE Access*, vol. 9, doi: 10.1109.

[8] T.L. Cherry and L. V. Ellis, "Does Rank-Order Grading Improve Student Performance?", *International Review of Economics Education*, vol. 4, no. 1, pp. 9-19, 2005.

[9] "Importance of Providing Meaningful Student Feedback - Center for Teaching Excellence | University of South Carolina," *sc.edu*. https://sc.edu/about/offices_and_divisions/cte/teaching_resources/grading_assessment_toolbox/providing_meaningful_student_feedback/index.php#:~:text=Feedback%20is%20any%20response%20regarding

[10] J. Fransen, "The Power of Peer Feedback in the Master Programme Learning & Innovation," *Workshop ATEE 2011 Conference*. https://www.researchgate.net/profile/Jos-Fransen/publication/266508249_The_Power_of_Peer_Feedback_in_the_Master_Programme_Learning_Innovation/links/5458ae5d0cf26d5090abfe69/The-Power-of-Peer-Feedback-in-the-Master-Programme-Learning-Innovation.pdf

[11] B. Walsh, S. Nixon, C. Walker, and N. Doyle, "Using a Clean Feedback Model to Facilitate the Learning Process," *Creative Education*, vol. 06, no. 10, pp. 953–960, 2015, doi: 10.4236/ce.2015.610097.

[12] J. Hattie and R. Jaeger, "Assessment and Classroom Learning: a deductive approach," *Assessment in Education: Principles, Policy & Practice*, vol. 5, no. 1, pp. 111–122, Mar. 1998, doi: 10.1080/0969595980050107.

[13] M. Guardado and L. Shi, "ESL students' experiences of online peer feedback," *Computers and Composition*, vol. 24, no. 4, pp. 443–461, Jan. 2007, doi: 10.1016/j.compcom.2007.03.002.

[14] D. Boud and N. Falchikov, "Aligning assessment with long-term learning," *Assessment & Evaluation in Higher Education*, vol. 31, no. 4, pp. 399–413, Aug. 2006, doi: 10.1080/02602930600679050.

[15] K. Lundstrom and W. Baker, "To give is better than to receive: The benefits of peer review to the reviewer's own writing," *Journal of Second Language Writing*, vol. 18, no. 1, pp. 30–43, Mar. 2009, doi: 10.1016/j.jslw.2008.06.002.

[16] J. van der Pol, B. A. M. van den Berg, W. F. Admiraal, and P. R. J. Simons, "The nature, reception, and use of online peer feedback in higher education," *Computers & Education*, vol. 51, no. 4, pp. 1804–1817, Dec. 2008, doi: 10.1016/j.compedu.2008.06.001.