International Journal for the Scholarship of Teaching and Learning

Volume 5 | Number 1 Article 20

1-2011

Impact of Giving Students a Choice of Homework Assignments in an Introductory Computer Science Class

Steven Fulton
United States Air Force Academy, steven.fulton@usafa.edu

Dino Schweitzer
United States Air Force Academy, dino.schweitzer@usafa.edu

Impact of Giving Students a Choice of Homework Assignments in an Introductory Computer Science Class

Abstract

Student assignments have long been an integral part of many university level computer science courses to reinforce material covered in class with practical exercises. For years, researchers have studied ways to improve such student assignments by making them more interesting, applicable, and valuable to the student with a goal of improving learning outcomes by increasing student appeal. One often studied way to improve the learning outcome is by allowing students a choice in assignments. To ensure fairness for all students in providing such a choice, care must be taken to ensure assignment "equality" by ensuring an equal learning experience for all students regardless of their choice of homework assignments. Our introductory computer science class is a survey class which covers multiple topics including programming concepts, word processing, presentation software, computer security, spreadsheet usage and databases design and implementation. Students perform several programming exercises throughout the course to demonstrate their knowledge and improve their skill in programming. For a number of years, we've offered students a choice on their final assignment. Worth 10% of the course grade, the assignment provides students with either an analytical programming project or a software applications based project. The purpose of this paper is to look at the motivations that drove students to make the choice they did and the impact of their choice on their assignment grade and overall performance on the course final. Our findings indicate that care must be taken when offering options to the student as the choice the student makes may unintentionally and adversely affect both their learning experience and course performance.

Keywords

Student homework choice, Introductory computer science, Homework exercises

Impact of Giving Students a Choice of Homework Assignments in an Introductory Computer Science Class

Steven Fulton
United States Air Force Academy
Colorado Springs, Colorado, USA
steven.fulton@usafa.edu

Dino Schweitzer
United States Air Force Academy
Colorado Springs, Colorado, USA
dino.schweitzer@usafa.edu

Abstract

Student assignments have long been an integral part of many university level computer science courses to reinforce material covered in class with practical exercises. For years, researchers have studied ways to improve such student assignments by making them more interesting, applicable, and valuable to the student with a goal of improving learning outcomes by increasing student appeal. One often studied way to improve the learning outcome is by allowing students a choice in assignments. To ensure fairness for all students in providing such a choice, care must be taken to ensure assignment “equality” by ensuring an equal learning experience for all students regardless of their choice of homework assignments. Our introductory computer science class is a survey class which covers multiple topics including programming concepts, word processing, presentation software, computer security, spreadsheet usage and databases design and implementation. Students perform several programming exercises throughout the course to demonstrate their knowledge and improve their skill in programming. For a number of years, we’ve offered students a choice on their final assignment. Worth 10% of the course grade, the assignment provides students with either an analytical programming project or a software applications-based project. The purpose of this paper is to look at the motivations that drove students to make the choice they did and the impact of their choice on their assignment grade and overall performance on the course final. Our findings indicate that care must be taken when offering options to the student as the choice the student makes may unintentionally and adversely affect both their learning experience and course performance.

Keywords: Student Homework Choice, Introductory Computer Science, Homework Exercises

Introduction

Different programs have different philosophies regarding topics and methodologies to be used in teaching introductory computer science courses (Sloan & Troy, 2008; Wellman, Davis, & Anderson, 2009). Some programs focus on a literacy approach in which high level topics about computers and their applications are presented primarily in lecture format. Other programs focus on computer applications and provide students with hands-on experience using common tools such as word processing and spreadsheets. A third approach is to focus on algorithmic problem solving in which students learn the syntax and semantics of a specific programming language or system to solve problems. Occasionally, this approach uses non-traditional programming environments such as robots, animation

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

systems, and legos. Our program uses a hybrid approach that attempts to address multiple areas: algorithmic problem solving, computer literacy overview, and experience with applications in computer science. The course objectives are shown in Table 1.

Table 1: Course Objectives

Main Course Objectives	**Sub Objectives**
Understand how Information Systems work	Understand how computer components work and interact Understand how software controls computer operations Understand how computer systems represent information
Be able to use algorithmic systems effectively	Be able to effectively manage a personal computer system Be able to install, configure and use computer programs Be able to manage electronic information securely Be able to effectively leverage the additional capabilities provided by networked computer systems
Be able to apply algorithmic reasoning to problem solving	Express process as algorithms Recognized algorithms within systems Read and understand algorithms Develop algorithms
Appreciate the impact and key issues of IT within society	Understand how IT is used within society Understand the social and ethical implications of computing.

Regardless of the approach used, it is common for major student projects to be an integral part of the course. Occasionally, students have a choice regarding their project type or topic. This paper looks at the project choice provided in our course, and its impact on student performance. Our Introduction to Computer Science course is taught as part of the core curriculum required by all students to complete in their freshmen year.

Our course covers six broad topics including information representation, algorithmic thinking, computer systems (hardware and system software), computer applications (user software tools), information and computing security, and modeling and simulation. These six topics are organized into blocks of related materials which build upon themselves throughout the course. The class is organized into a total of 40 lessons most of which are lecture-oriented. Readings associated with the course come from a series of locally developed materials.

Assessment of performance in the class consists of quizzes, in-class assessments, homework problems, and a final exam. The in-class assessments require students to demonstrate their knowledge in programming assignments as well as configuring and querying an Access database. The homework problems are primarily programming assignments. There are a total of eight homework assignments, the first seven of which are preset problems that everyone completes. For the final homework, however, students are given the opportunity to choose from two different assignments: a programming assignment or an application-oriented assignment. Class time is provided to complete this assignment.

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

This student choice opportunity has been provided for several years and was originally offered as a *kinder gentler* approach allowing students an opportunity to choose the assignment type with which they felt most comfortable. The assignment is either solving an in-depth programming effort or a detailed management information systems problem using standard Microsoft Office applications. Students are given up to four in-class sessions to complete this final assignment. The only remaining graded event following this assessment is a two-part comprehensive final exam. The exam has both a written portion as well as a section focusing on programming skills in which students demonstrate their ability to solve multiple programming problems.

In our hybrid course, different teaching approaches are used for the various topic areas. While the information representation, computer security and modeling and simulation sections are typically more traditional lecture modules, the software applications module consists of seven hands-on lessons which cover the use of Microsoft applications including Microsoft Word, PowerPoint, Excel, and Access. Included in these seven lessons is the database assessment mentioned previously.

The algorithmic thinking module is 13 lessons long and covers basic programming techniques using the RAPTOR Programming Environment (Carlisle, 2009). RAPTOR is a flowchart based programming environment, "designed specifically to help students visualize their algorithms and avoid syntactic baggage." RAPTOR provides students with a programming option which removes the need for a strong syntax-based programming environment allowing students to develop programs using flowchart symbols. Many students have never experienced any programming environment prior to this class and therefore RAPTOR allows them to quickly develop complex programs. RAPTOR has been used for several years and was specifically chosen to allow students to demonstrate programming skills without having to learn formal syntax of a programming language such as Java or C++.

As previously mentioned, the eighth homework assignment, or the "choice" assignment, is offered at the end of the semester and covers four course sessions. During these sessions, the instructor is available to answer questions regarding the programming assignment or application problem. The programming option is typically a simple game such as *Nim* or *Simon*. The applications problem is an in-depth analysis of a subject which requires the student to use all applications taught (Microsoft Access, Word, PowerPoint and Excel) to fully analyze a problem and present associated data in a given format.

The remainder of this paper will look at the impact of providing students with this choice. Section 2 will provide some background information from the literature. Section 3 will present our findings, both why students chose the option they did, and what the impact was on their final performance. Finally, we provide some conclusions from our study.

Background

Student assignments are an integral part of any computer science course. Researchers have examined how to improve such assignments by making them more interesting, applicable, and perceived as valuable to the student. In the computer science field, the creation of programming assignments follow much the same steps as other fields: creating an assignment which demonstrates the learning objective of the material as well as provide

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

some interest to the students who will be completing the assignment (Layman, Williams, & Slaten, 2007). These assignments may attempt to demonstrate given mathematical functions, business functionality or even game creation. Researchers, in the past few years, have begun to look at ways to motivate students by providing a choice in classroom assignments (Aycock & Uhl, 2005; Cliburn & Miller, 2008; Layman, et al., 2007). Specific types of choice include the opportunity to complete additional problems, adding embellishments to existing assignments or even providing the opportunity to optionally resubmit corrected assignments (Becker, 2006).

Choice in the classroom through contract weighting of assignments has been discussed specifically as it related to the empowerment of students to take control of their course. Of most significance is the ability of students to take control of their class by allowing them a 'time bank' which permits them the ability to control due dates by having a grace period to slip due dates once in a given course. Students not only found this helpful but it also helped reduce the total requests for homework extensions from instructors (p. 85). Recent studies have also looked at the relationship of choice as a motivational factor (Radenski, 2009), the amount of choice in a given environment (Becker, 2006), the type of choice students prefer (Cliburn & Miller, 2008), and the value of choice in weighting of classroom assignments (Aycock & Uhl, 2005).

To summarize, the advantages of offering students a choice of assignments are

- Empowers students to take control
- Provides ownership of learning process
- Motivates students to become engaged
- Increases interest, thus increasing time spent

An associated advantage of offering a choice in homework assignment is that intrinsic motivation or the inherent human tendency to seek out novelty and challenges which allow one to exercise one's abilities would exist in such a scenario (Ryan & Deci, 2000). This basic tenet of intrinsic motivation suggests that a choice in homework would allow students to gravitate towards assignments which have the most benefit to their learning effort while increasing interest. Svinicki (2007) suggests that motivation towards a goal may not be as simple as intrinsic desire claiming an amalgamated model of motivation with goals influenced by learner orientation. This learner orientation is affected by goal value (perceived needs, intrinsic qualities of goal, utility of goal, control and choice and influence of others) balanced with learner expectation that a goal can be achieved (difficulty of goal, prior experience, match of goal with learner skills, encouragement of others, self-efficacy with respect to goal, attributions about success and failure, beliefs/attitudes about learning). Svinicki synthesized this motivational concept into seven strategies which enhance student motivation:

- Good role models of appropriate motivation
- Instructor choice of learning tasks with utility, challenge and interest value to students
- Instructor encouragement of accurate student self efficacy
- Instructor evaluation on progress to produce mastery of goal
- Instructor attribution of success to efforts and ability to interpreting mistakes as learning opportunities

https://doi.org/10.20429/ijsotl.2011.050120

- Students being provided choice over goals
- Instructor communication of high expectations in line with student capabilities.

Svinicki's work implies that intrinsic motivation alone will not cause a student to make the most advantageous choice when deciding on an assignment but that the instructor plays a key role in such decision making processes.

Nicholls (1984)offers a slightly different view of task choice by students suggesting that an individual's choice is not necessarily to choose that which would help them succeed in a long term goal but instead to maximize their chances of demonstrating high ability and avoiding demonstration of low ability. A corollary offered by Nicholls is that once an individual is involved in a task and sees it as leading to success would be more likely to demonstrate mastery of that task.

Billington, Skinner and Curchon (2004) take a different approach. Working with sixth grade students they found that when given choice over two different homework assignments that students would choose the more difficult choice and rate it as requiring less work if they were provided with additional brief problems that helped them prepare for the skill. This concept of using discrete tasks as reinforcement suggests that interspersing such tasks in a class could increase the probability of students choosing more challenging assignments. Shapira (1987), however, sees issues in this for learners who are specifically intrinsically motivated suggesting that when choosing task difficulty, such learners perform poorly when given specific goals to reach that learning objective.

Along with the advantages of offering a choice, however, care must be taken to ensure the choices are "fair". Specifically, they should

- Be of similar complexity, i.e., take a roughly equivalent amount of time to complete
- Provide a similar opportunity for awarded points
- Provide similar learning experience for student

The first two of these are obvious; students should not have an unfair advantage by selecting an "easier" option or one that gives them a higher grade. The third factor, however, is more subtle. In addition to assessing performance, homework assignments provide students with a valuable learning experience. However, if one option provides a different learning experience that improves a student's ability to perform in the course, this can be interpreted as being given an unfair advantage to that student. This factor would be obvious if the choices were vastly different in which one option had little, if anything, to do with the course. However, even if all options are aligned with course objectives, this bias may exist. It is this factor that we wanted to explore more carefully in our course.

In our class, 10% of the final grade is allocated to the outcome of the choice homework assignment. The choice relates to which of two assignments the student wishes to attempt. This paper looks at the motivations that drive students to make the choice they did and examines the impact of that choice on both their assignment grade as well as their course performance.

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

Findings

To investigate the impact of student choices in our introductory computer science class, we collected survey and performance data from 521 students who took the course in spring semester 2009. We also canvassed the 16 instructors teaching the course to get their input on why students selected a particular choice, the relative amount of work, and student reactions. The Choice Homework occurred late in the semester after 65% of the course points had already been awarded. The homework itself was worth 100 points, or 10% of their course grade. Students had a choice of either a RAPTOR programming assignment, or an application-oriented assignment consisting of analyzing a problem and using various software tools to solve and document it. The only remaining graded event after the homework was the final exam that was worth 25% of their final grade.

The focus of the study was to answer two basic questions: 1) why did students choose the option they did, and 2) what impact, if any, did the choice have on their final performance and grade in the course. Each of these will be examined in more detail.

Reason for Choice

To determine why students made the choice they did, we conducted a survey of all students taking the class. The survey specifically asked three questions: Which choice homework did you choose, why did you choose the assignment that you did, and do you feel that you learned something from the assignment. Out of a total of 521 registered students, we received 386 usable responses. These responses provided a view of the rationale behind the student choices.

The findings of the survey are outlined in Figure 1. Seventy percent of the students who choose the application assignment did so based on the assumption that it was the assignment which would provide them the most points. This compares with 23% of the students who chose the RAPTOR assignment. This suggests two things: students who chose the applications homework felt the need to gain as many points as possible in this assignment (possibly suggesting poorer performance than those who chose RAPTOR) and that the students were more focused on short-term point gain than learning skills that could help them with their final exam grades. This supports Nicholls (1984) theories that students become more focused on short term point gain than a more long term intrinsic motivational value proposed by Ryan and Deci.(2000)

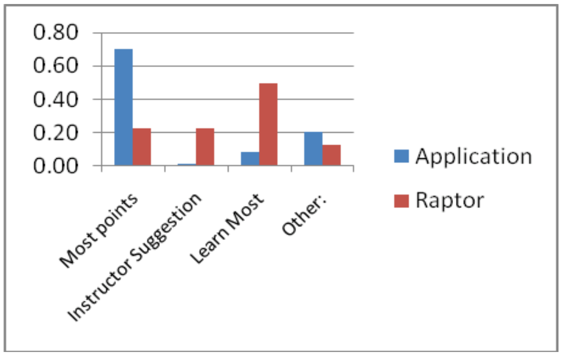

Figure 1: Student Rationale for Choice

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

Through observations of the course instructors, there has been a long held belief that students who choose the RAPTOR choice assignment were better prepared to complete the course final. In other words, the learning experience gained from this choice was of greater value to the student in terms of overall course performance. As such, a number of instructors told their students that it would be best if they choose one assignment over another (typically choosing RAPTOR over the application assignment). While only one percent of the students who made the choice of the applications homework indicated that their instructor suggested it, 23% of the students who chose the RAPTOR homework claimed that their instructor advocated that homework choice.

Forty-nine percent of the students said that they choose the RAPTOR homework because they felt that they would learn the most from that assignment while only 8% of the applications students made that claim. This suggests that either a) students who chose RAPTOR for their homework assignment were willing to take a chance at increasing their knowledge or skills while not worrying about gathering the most points for their final grade, or b) they felt they knew the other area well enough to not require further practice.

Twenty percent of the students who made the applications choice and 13% of those who chose RAPTOR stated that 'other' as their rationale for making their choices. The response from those who chose the Application assignment narrowed down to four general areas: More comfort with the Microsoft Applications than RAPTOR, more applicability to future jobs, learning of a new skill, or that they had started working on both but seemed to be making more progress on the Application choice. 58% noted it was either a comfort level with the Microsoft Applications or not being comfortable with RAPTOR that drove their choice. 26% of these suggested that the applicability of the Microsoft to new jobs drove their choice. The results of this are outlined in Table 2.

Table 2: Application Students with 'other' as reason for choice

Reason	**Percentage**
Comfort with Access/uncomfortable with RAPTOR	58%
Started working Both	5%
Learn New Skill	11%
Applicable to new jobs	26%

Of the 13% of those who chose 'other' as their rationale for choosing the RAPTOR assignment, the common themes were comfort with using RAPTOR; preparation for final; more of a challenge; more applicable in the future; or more fun. The vast majority of these were found in the "comfort with using RAPTOR" (38%) and "good review for the final" (50%). The full standings are shown in Table 3.

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

Table 3: RAPTOR Students with 'other' as reason for choice

Reason	Percentage
Review for Final	50%
Ease of Use/Better at RAPTOR	38%
Fun	5%
Challenge	3%
More Applicable in Future	3%

When asked if they felt that they learned from the choice homework assignment, the response was overwhelmingly positive yet those who choose the application assignment were more likely to claim that they learned something from the assignment (98%) than those who choose the RAPTOR assignment (89%) suggesting that as a learning tool, both assignments were beneficial.

Impact of Choice

Both choices in the Choice Homework were worth 100 points. An attempt was made to make both options an equivalent level of student effort to complete, and to grade the results so that the overall grade results were similar. Level of effort was determined from instructor input. 69% of the instructors indicated the level of effort demonstrated by their students were roughly equivalent. 23% thought the RAPTOR problem took more effort and time, and only one instructor responded that the application problem took more effort to complete.

The next consideration was whether the grading on the two choices was different. Figure 2 shows the distribution of grades for both options. The average grade on the homework for students choosing the RAPTOR option was 95% versus 91% for students selecting the application option. As the figure shows, fully half of the students doing the programming exercise received a 95% or higher. In discussions with instructors grading the homework, one of the reasons for the higher distribution is that the programming exercise tended to be more of a quantitative “they did it correctly or not” as opposed to the more qualitative evaluation of the application homework. At first glance, it would appear that selecting the RAPTOR option helps students more. However, another factor that needs to be considered is the quality of student selecting the RAPTOR problem. The grade average for students selecting RAPTOR was three percentage points higher than students selecting the other option (81% versus 78%) before the selection was made. Thus, the impact of the homework grade was that both groups increased their overall course average by 2% as a result of this assignment. This finding, coupled with the fact that most students choose the RAPTOR problem over the applications option, suggests that external motivation over choice homework may help students make an appropriate choice for their long term success supporting Svinicki’s (2007) motivational strategies.

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

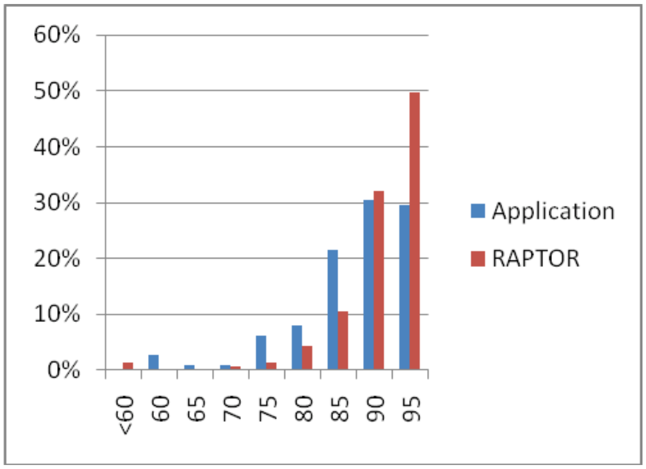

Figure 1: Distribution of grades on homework

The final factor to investigate, and perhaps the most important, was to evaluate the learning experience for the two groups. While, arguably, both experiences provided some learning experience, we focused on which selection helped students overall in the course by better preparing them for the final exam. 29% of the course grade is based on programming assignments; 20% prior to the homework, and 9% on the final exam.
Several instructors encouraged their students to select the RAPTOR option to get more practice and be better prepared to take the final. Table 4 shows the results of performance by both groups. Note that the group that did not select the RAPTOR option only marginally performed better on the programming final increasing by less than 1%. Students completing the RAPTOR option, however, improved more than three times their application counterparts with a 2.4% increase.

Table 4: Performance on RAPTOR portion of final exam

Option	RAPTOR % prior to Homework	RAPTOR % on Final Exam	Increase
Application	70.9%	71.6%	0.7%
RAPTOR	75.8%	78.2%	2.4%

While it seems obvious that additional practice will help students perform better, a premise that several instructors held was that it especially helped students who struggled with RAPTOR prior to the homework. As such, they encouraged weaker students to select the RAPTOR option as it would help them more in the long run. To investigate that premise, we first looked at the distribution of student performance on RAPTOR prior to the homework. Figure 3 shows the distribution of performance on RAPTOR problems prior to the homework. Note that students selecting the application problem were definitely skewed toward the lower end of the distribution while students selecting RAPTOR were more toward the high end.

https://doi.org/10.20429/ijsotl.2011.050120

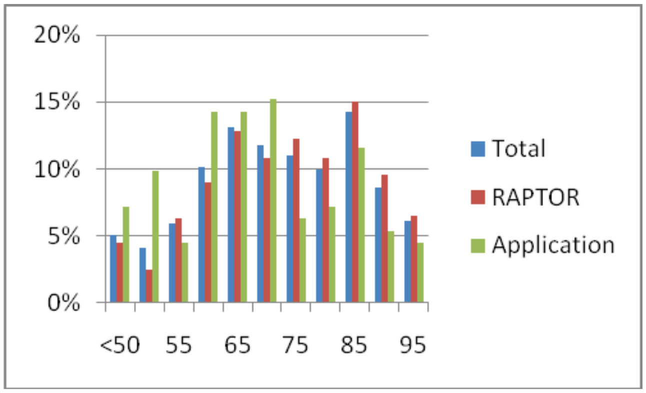

Figure 2: Distribution of RAPTOR performance prior to homework

To determine the impact of the RAPTOR option for the lower performing students, we only considered students who averaged 65% or less on RAPTOR problems prior to the homework. That represented 25% of all students, 22% of the students who selected RAPTOR, and 38% of students selecting the application option. Table 5 shows the results of RAPTOR performance prior to the homework and on the final exam for this group of students. While both groups did significantly better, the lower students who selected the RAPTOR portion had a greater increase in their final score**.**

Table 5: Performance on RAPTOR portion of final exam for lower performing students

Option	**RAPTOR % prior to Homework**	**RAPTOR % on Final Exam**	**Increase**
Application	53.6%	63.9%	10.3%
RAPTOR	53.6%	67.5%	13.9%

Besides performance on RAPTOR, we wanted to investigate if there was any advantage to students selecting the application option on the non-RAPTOR portion of the final. A similar comparison was made to determine whether the application group benefitted from their experience and scored higher on the non-RAPTOR portion of the final than the other group. Table 6 shows the results. Needless to say, neither group improved, and there was no difference in performance regardless of the homework choice. Since the majority of non-RAPTOR questions on the final exam were on computer science concepts versus application-specific questions, these results are not surprising.

Table 6: Performance on non-RAPTOR portion of final exam

Option	**Non-RAPTOR % prior to Homework**	**Non-RAPTOR % on Final Exam**	**Increase**
Application	81.2%	72.6%	-8.6%
RAPTOR	83.1%	74.6%	-8.5%

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

Conclusions

Providing students with a choice of homework assignments may offer some qualitative increase in student enjoyment of the course by allowing them to feel like they have some control of their destiny. However, the cost of providing that flexibility is that students may not receive the same level of learning experience. As a result, their overall performance, and grade can be affected. Algorithmic problem solving represents about a third of the emphasis in our course as measured by the number of points assigned to it. Students who gain extra experience by selecting the programming option, even if they felt compelled to do so by their instructor, performed better on this aspect of the course (at least, in theory, gaining more knowledge by doing so). This is especially true for students who struggled with programming concepts prior to the homework. Furthermore, when providing such choice assignments, it may be of benefit for instructors to provide motivation to students either in the form of Svinicki's (2007) strategies or by using intermediate tasks (Billington, et al., 2004) to guide students to the choice which best brings about mastery of the subject.

The results of this study reinforce what instructors have believed to be the case based on personal observations in the classroom. By allowing students to select a perceived "easier" choice homework, we are potentially providing a disservice to them in both their final grade in the course, and the knowledge gained.

In general, as evidenced in our study, simply ensuring that assignment options have a similar required level of effort and are graded equitably is not sufficient. Consideration must be given to the learning experience gained from different choices, and their overall impact on the student. Even when student choices are aligned with course objectives, the results may not be equitable. Rather, it is critical to balance the advantages gained from providing students with choices with the overall student learning experience.

References

Aycock, J., & Uhl, J. (2005). Choice in the classroom. *SIGCSE Bull., 37*(4), 84-88.

Becker, K. (2006). *How much choice is too much?* Paper presented at the Working group reports on ITiCSE on Innovation and technology in computer science education.

Billington, E., Skinner, C., & Cruchon, N. (2004). Improving sixth-grade students perceptions of high-effort assignments by assigning more work: Interaction of additive interspersal and assignment effort on assignment choice. *Journal of School Psychology, 42*(6), 477-490.

Carlisle, M. (2009). Raptor: a visual programming environment for teaching object-oriented programming. *Journal of Computing Sciences in Colleges, 24*(4), 275-281.

Cliburn, D., & Miller, S. (2008). *Games, stories, or something more traditional: the types of assignments college students prefer*.

Layman, L., Williams, L., & Slaten, K. (2007). *Note to self: make assignments meaningful*.

https://doi.org/10.20429/ijsotl.2011.050120

International Journal for the Scholarship of Teaching and Learning
http://www.georgiasouthern.edu/ijsotl
Vol. 5, No. 1 (January 2011)
ISSN 1931-4744 @ Georgia Southern University

Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological review, 91*(3), 328-346.

Radenski, A. (2009). *Freedom of choice as motivational factor for active learning*.

Ryan, R., & Deci, E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68-78.

Sloan, R., & Troy, P. (2008). *CS 0.5: a better approach to introductory computer science for majors*.

Svinicki, M. D. (2007). *Learning and motivation in the postsecondary classroom*. Bolton, MA: Anker.

Wellman, B., Davis, J., & Anderson, M. (2009). *Alice and robotics in introductory CS courses*.

https://doi.org/10.20429/ijsotl.2011.050120