

Fat Points and Fairness: Inserting a Minor Game Mechanic in the Syllabus

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Abstract

The hallmark of a well-designed game is player persistence - the same characteristic professors hope to cultivate in their students, especially in the face of the student retention crisis. The four studies reported here include an archival study, a focus group, and two experiments. They each test a minor game mechanic that may have a small but reliable influence on students' academic motivation: the total number of possible points that may be earned in a course. Students framed the number as an issue of fairness (or unfairness) related to the course's grading rubric. In Study 1, an archival study of PsycINFO found an increasing number of references to game design. In Study 2, a focus group of mathematics students reacted negatively to courses with very few possible points. In Studies 3 and 4, experiments indicated that students associated excessive possible points ("fat" points) with fairness and few possible points ("thin" points) with unfairness and difficulty. If such a minor, easily manipulated game mechanic can influence students' perceptions, then more sophisticated game mechanics may be able to induce even greater motivation.

Keywords: Game-Based Assessment, Experience Points, Learner Motivation, Student Retention, User Experience

1. Introduction

There is a growing financial crisis permeating higher education, and its most obvious cure is to increase student retention. The summary of that literature is that yes, going to college – any college – has become extremely expensive, but data from the Bureau of Labor Statistics (2011) indicates that in the long term, on average, the only thing more expensive than going to college is not going to college when we examine the salary differences between those who have graduated with a college degree and those who have not (Black and Huelsman, 2012). The Game-Based Experience Lab at William Paterson University is applying principles of game design to the social problem of low college completion rates.

What, if anything, can we as teachers do to increase our students' academic motivation? The studies reported here connect psychology's motivation literature to the principles

of game design. Several scholars have worked "to seed a research community" devoted to connecting psychology's motivation literature to game design, often for practical purposes, such as student retention (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011, p. 2427).

2. Literature Review

Cultural references to the motivational importance of games are scattered across the human record. For example, in the biblical story of Jonah and the whale, storm-tossed sailors discovered the will of God by playing a game of dice before they sacrificed Jonah to the angry sea. The Greek stoic philosopher Epictetus recommended that, if we are sufficiently motivated to keep playing the game of life, then we should stop grumbling.

In the early years of the discipline of psychology, Karl Groos (1901) recognized the evolutionary importance of

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games for the social development of humans and other animals. Likewise, early contributions to educational psychology emphasized the importance of play and games (Dewey & Findlay, 1909). Play and games engage fundamental evolutionary urges that continue to be expressed as Evolved Psychological Mechanisms (EPMs) (Barrett, Frederick, Haselton, & Kurzban, 2006).

3. Games and Learning

3.1 Games and Motivation

There is a more explicit, 40-year history in the literature about motivation psychology and game design, perhaps beginning with early studies of human-computer interactions (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Malone, 1980). More recently, teachers and researchers have noticed the motivational pull of video games, in particular (Ryan, Rigby, & Przybylski, 2006). Applied social psychologists were among the first to recognize the opportunities within game design. Lockton, Harrison, and Stanton (2010) described the connection between motivation and game design as “designing with a purpose.” A well-designed game can deliver an experience to a player that first engages, and then subtly transforms, player motivations from extrinsic to intrinsic (Dickey, 2007). Game designers deliver those motivating experiences through game mechanics- the rules and features that make a particular game more (or less) effective (Schell, 2008).

3.2 Two Motivating Game Mechanics

Game designers think of the motivational mechanics of games using a distinct language that parallels established principles of psychology (Heinzen, Gordon, Landrum, Gurung, Dunn & Richman, 2015). The first game mechanic conceptually relevant to these studies is simply called “onboarding,” a conscious engagement approach that forms a critical first impression about a game (or a course). The second is “failing forward,” a concept related to mastery learning.

On boarding is critical to student retention because first impressions create generalizing halo effects, a perceptual process also known as “thin slicing” (Ambady & Rosenthal, 1992; see Forgas & Laham, 2016, for a review), where a very small sample of information is perceived as representative of the whole. The on boarding effectiveness of first impressions in a college class have

been validated experimentally (Samudra, Min, Cortina, & Miller, 2016). For example, Buchert, Laws, Apperson, and Bregman (2008) found that students' end of the year course evaluations were influenced more by first impressions of the professor than by all of the professor's subsequent efforts over the remainder of the semester.

Failing forward is a second motivational game mechanic relevant to student success. It provides multiple opportunities to fail until the player/student masters the content or task, i.e., mastery learning (see Schell, 2008). Bieg, Reindl, and Dresel (2017) studied mastery goals and intrinsic motivation in a longitudinal study of more than 1,100 students. They found that, over 10 weeks, students consistently rated mastery goals as more motivating than intrinsic motivation. In the study, mastery goals seemed to pave the way for the intrinsic motivation that followed. Toddlers, for example, learn to walk by persistent falling, stumbling, grabbing, tripping, and climbing. “Failing forward” is how they learn to walk.

3.3 Game Design and Grading Rubrics

Effective grading schemes may be related to some features of game design. Dubey (2010) took advantage of our game-playing impulse and introduced grading into games of status that allowed players to choose their level of effort. Francis and Schreiber (2008) created daily interactive quizzes that were so effective that students were disappointed when they were not quizzed. The success of the students appeared to be related to the game mechanic of failing forward. “The quizzes are more of an enjoyable game with a win-win scoring system than a threatening evaluation” (p. 179).

The successful manipulation of points provided “continuous feedback as students see scores recorded, [and] the class's and their team's cumulative point totals graphically displayed in real time” (p. 180). The students' understanding was that the scoring system with timely feedback loops worked well because the bonus points were free, could only improve grades, fostered cooperation, teamwork, facilitated learning from one another, and created new social incentives to perform well. Those concepts represent game mechanics already familiar to game designers (Heinzen et al., 2015). In the context of these studies, the advantage of a course with many possible points is that it creates opportunities to design more rewarding feedback loops.

Grading rubrics may be important to students because they influence perceptions of fairness and unfairness. The importance of perceived fairness is not limited, of course, to students or to academic settings. Schweitzer (2013) proposed a careful (i.e., fair) grading scheme to solve the prescription drug shortage problem. As early as 1995, Callan described how the hotel industry was already using improved scoring rubrics to provide fairer feedback and improve quality of service. Just as fairness seems to increase motivation across diverse industries, perceptions of unfairness (this time among public employees) decreased motivation by undermining their intrinsic motivation (Wenzel, Krase, & Vogel, 2017).

Consequently, we hypothesized that courses with potentially extravagant point totals would increase students' perceptions of fairness and academic motivation. The first impression made by the points described in a syllabus seemed like the obvious, pragmatic place to start. We also noticed that one feature common to many video game designs is high, or even unlimited, possible points. For example, Tetris and Pac-Man are classic games with point opportunities into the hundreds of thousands. They, in turn, are reminiscent of the pinball games that occupied previous generations of gamers. Possible points are a prominent feature of many successful games but, to our knowledge, have not appeared to interest academic course designers.

4. Research Study

4.1 A Research Strategy

The research strategy behind the studies reported here started with the possible number of points for three reasons. First, the total number of possible points does not matter when the grade determination is based on the percentage of points earned. Second, the number of points in a syllabus is easy to manipulate experimentally. Third, if such a minor game mechanic influences student motivation, then we are encouraged to explore the larger motivational promises of game design. For example, game-based assessment may be able to capture authentic learning when students, especially at-risk students, are striving to win rather than enduring another standardized test (Heinzen, Landrum, Gurung & Dunn, 2015).

4.2 Method

For clarity, we have chosen to describe and report each of the four brief studies under just two headings (Methods

and Results), rather than as separate studies. In Study 1, we used a combination of archival analyses to explore the growing interest in game design expressed in PsycINFO. In Study 2, a mathematics professor conducted a brief focus group on attitudes among his students related to the total number of possible points. Studies 3 and 4 used random assignment to groups with slightly different grade-measuring techniques.

Study 1. Two archival analyses tested the frequency of game-related references in PsycINFO by decade, both with and without searching for the terms “gaming” (often associated with gambling) and “game theory” (a popular research paradigm). The first All Text (TX) search included “game” or “games” or “gamification” or “game design” or “gamer” or “gamers”. A second search added “game theory” or “gaming”. The estimates for the decade 2010 to 2019 are likely underestimates. Although the trend is consistently upward, we used the more conservative average across the previous years, 2010 through 2017, to predict the number of hits in the years 2018 and 2019.

Study 2. A mathematics professor interviewed students in his remedial mathematics class near the beginning of the semester. He asked them to react to alternative grading schemes involving possible points for the course expressed as a single digit (1 possible point), a more familiar three-digit system (100 possible points), and an extravagant number of points (10,000 possible points).

Study 3. We randomly assigned 88 participants in a history of psychology class to evaluate the scoring system expressed in a syllabus for a proposed new course that had six different possible point totals of 1, 100, 10,000, 4,400, or 40,000. The proposed transformation from points to letter grades was identical in each condition and communicated to students in a table: 90% = A; 80% = B; 70% = C; 60% = D. The scoring distribution for earning points within the course was also clarified based on three quizzes (5%, 15%, 20%), a midterm (30%), and a final (30%).

We asked students to write a few words about what it was about the grading scheme that gave them the impression of how fair, difficult, or motivating the course would be. In their written reactions, 80% of students wrote something that allowed us to conduct word counts related to the fairness or unfairness of the grading rubric. Multiple expressions by a single student were counted multiple times, but seldom occurred and only to a minor degree.

We also created a scale that used either four or five items to measure each of the following constructs: perceived fairness, difficulty, and motivation. We created items for each construct that had face validity such as, “My impression from the grading scheme is that this course will be fair” (or) “will be difficult” (or) “will discourage me” (reverse scored).

Many students did not appear to take the quantitative assessment seriously; many either circled sets of numbers or simply did not respond. We probably used too many questions to measure too many constructs. This interpretation makes sense because their written comments appeared to elicit significant engagement (Appendix A). We decided not to analyze the quantitative data. For the written data, we counted the frequency of comments related to fairness, unfairness, and difficulty. There were too few comments about motivation to make any inferences.

Study 4 was conducted about a year and a half later, but with only 39 participants. It replicated Study 3 with minor modifications. We limited the possible points to more plausible choices- 10, 100, and 1,000. We assessed impressions on a 1-5 scale. We limited the total number of items used to rate the syllabus to a fairness construct (fairness + unfairness reverse scored).

5. Results and Discussion

5.1 Study 1

Table 1 reports the frequency of game-related terms in PsycINFO by decade. The 2,308 “hits” in PsycINFO in the 1970s represented 82% of the database. The estimated 27,635 hits in the 2010s represents 1.5% of the total projected database. The almost 1,200% increase in overall hits requires a context: the PsycINFO database is growing rapidly. A conservative estimate for 2010-2019 is that there will be approximately 1.6 million articles in PsycINFO. Consequently, we controlled for the growth of the database by calculating the percentage of the database including terms related to games. Even with this control, the number of hits between the 1970s and the 2010s has risen by almost 200 percent.

Table 1. The increasing frequency of game-related terms in PsycINFO

All TX searches in PsycINFO	1970s	1980s	1990s	2000s	2010s (est.)
Game-Related Terms	1922	2560	3581	8350	21308
+ “Game Theory” & “Gaming”	2308	2902	4398	10501	27635

5.2 Study 2

The dominant reaction of the mathematics students in the focus group was that they did not like fractions as a grading scheme. The professor’s interpretation was that a total of 1 possible point was perceived as unfairly making their brains work harder than was necessary to understand an unnecessarily complicated scoring system. He summed up his report by saying, “They definitely don’t feel comfortable with fractions.” The professor described surprisingly strong reactions among students. This may have reflected a general dislike of mathematics, along with the adaptive tendency to be cognitive misers in a course that was already perceived as difficult and anxiety-provoking. The issue of fairness appeared to be most important to students, and this makes sense in terms of game design. Players in any contest are unlikely to play if they believe that the written or unwritten rules of the game are unfair.

5.3 Study 3

We were surprised in three ways when we counted the frequency of comments. First, the unfamiliar grading metric of either 4, 400, or 4,000 points seemed to bother students in ways reminiscent of the focus group. Second, students wrote about *unfairness* more than fairness

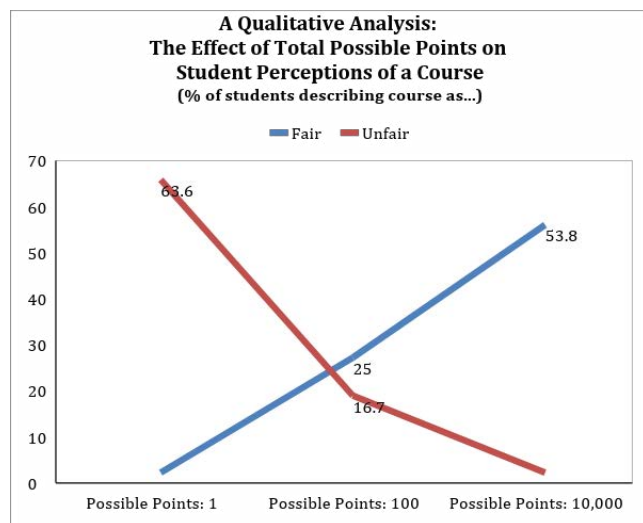


Figure 1. A qualitative description of students’ comments.

and focused on the distribution of effort required by the grading scheme. The opposite of fairness, to these students, is not exactly unfairness. The third surprise led us more directly to Study 4. Figure 1 indicates that most (63.6%) students rated a course with just 1 possible point as unfair; not a single student described it as fair. Most students (53.8%) described a course with 10,000 points as fair; none described it as unfair.

Some of the individual comments reported in Appendix A suggest possibly important individual differences. Two individuals indicated that the scarcity of points in a course with only one possible point was particularly motivating; it implied that every fraction of a point was precious and would require even more hard work.

5.4 Study 4

There were some confirming (face valid) correlations in the overall quantitative data (ignoring condition) indicating that our participants were sufficiently engaged to trust the quantitative data. For example, both “interesting/fun” and “fun/fair” were positively correlated [$r_{(39)}$ values $> .50$, $p < .001$]. And, as might be expected, “fair/unfair” and “difficult/easy” were both negatively correlated ($p < .01$). From a game design perspective, the most interesting correlations were that the item, “This statistics course will challenge me in a good way” was positively correlated with “fun” [$r_{(38)} = .534$, $p < .001$], with “fair” [$r_{(38)} = .341$, $p < .05$], and negatively with “unfair” [$r_{(38)} = -.416$, $p < .01$].

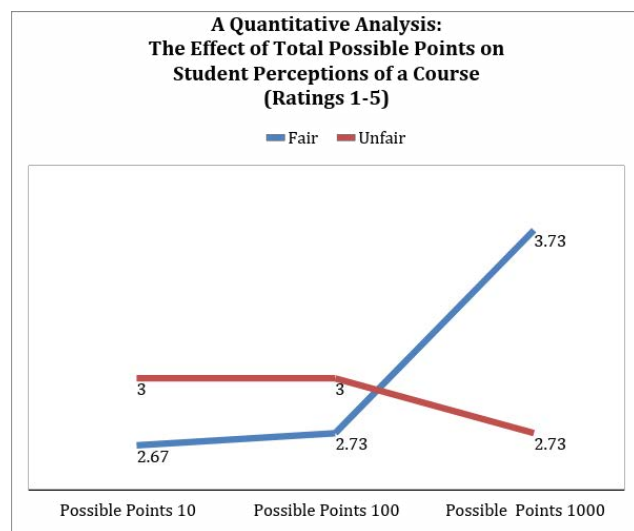


Figure 2. A quantitative description of students’ perceptions.

Therefore, a “fair” course seems to be perceived as a “fun” course.

A MANOVA testing the three-point conditions for both “fair” and “unfair” indicated that any differences were mostly related to “fair” [$F_{(2,35)} = 3.01$, $p < .07$]. Post-hoc LSD tests confirmed the story in Figure 1, indicating the most relevant difference occurred in a comparison between 1000 points and 100 points ($p < .05$) and 100 points ($p < .05$).

The value of presenting the data in Figure 2 is that it so closely replicates the pattern in the content analysis in Study 3. A total possible number of points of 1,000 is associated with fairness and not unfairness. The pattern, however, did not reach traditional measures of statistical significance. More importantly, these are relatively small differences that had weak effect sizes (and relatively large standard errors), based on a small sample size. In addition, sloppy handwriting and four students rating all items at the midpoint of 3 suggested that a subsample of four students were not as engaged as we would hope; we used their data but retained our skepticism. Modifying the comparisons to 10 possible points (rather than one) versus 1,000 possible points (rather than 10,000) also may have reduced the effect sizes, at least in comparison to Study 3.

5.5 Discussion

When assessing a course syllabus, students tended to respond favorably but irrationally to the number of possible points. On average, they perceived greater fairness in a syllabus with more possible points and more unfairness in a course with fewer possible points. Others have found similar irrational responses to numerical information, including a bias toward round numbers further modified by loss aversion (Frasher-MacKenzie, Sung, & Johnson, 2015). Game designers routinely use point manipulations to motivate players to persist at a very high level in contextually meaningless tasks (Schell, 2008). Our research provides modest experimental support for the idea that excessive (“fat”) points are likely to be perceived as fairer and therefore more motivating than very few (“thin”) points.

By themselves, these experimental manipulations are much cruder than the motivating experience of many points delivered by an accomplished game designer. Classic video games such as Tetris and Pac-Man, or the even older games of pinball, rely on excessive points

and enhance their effects with exciting acoustic and visual displays. They are also games in which players are guaranteed eventually to fail. The sense of the ability to fail forward may be more salient in a game with many possible points.

Fat points, of course, are not a requirement for an engaging game and are possibly of minor value when designing an engaging course. In addition, many highly successful games (soccer, hockey) are designed to make the points valuable by their rarity. There also may be a point at which fat points are devalued in various ways (basketball) (Felt, 2017).

However, these findings hint at both short-term utility and promising long-term implications when designing a course. In the short term, this minor game mechanic probably provides a painless, effortless way to form a slightly more positive first impression of “fun” and “fairness.” A syllabus with many possible points, on average, feels a little more playful and game-like. In the short term, these findings encourage further research about the usage of points. In the long term, these findings encourage a more compelling interest in how games and game design can become a positive force in the larger, and far more important, task of student retention.

6. Note

In the immediate future, we are conducting more research about how points with game-like features influence student perceptions of a syllabus. In addition to replications, we are using points in a syllabus to test the idea of failing forward. We are gathering student perceptions of a course that begins with zero points and builds to 100 (implying mastery learning) or begins with 100 points that must be defended against failing (representing a fear of failing rather than failing forward). Given the simplicity of conducting these experiments, we hope others will join us; we are glad to share our protocols. Data collection requires only a few minutes.

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Appendix A

Summary of Qualitative Comments in Study 3.

69 out of 86 (80.2%) made some comment, suggesting that they were engaged in the activity. Only three out of the 86 (3.5%) returned assessments that offered no response in writing or quantitative rating. Phrases in quotations are exact quotes; those without quotation marks summarize a student’s comments. Participants who made comments belonging to more than one category were counted more than once.

Condition 1. Possible Points = 1 (9/11 or 81.8% provided a comment)

Comments about Fairness: 0 Unfairness 7 Difficulties: 4

1. “What goes around comes around... Leave the grading system as it is.”
2. The unequal weighting of each quiz is unfair.
3. “...it will be unfair and somewhat difficult.”
4. Something about the quizzes...
5. Due to rewarding effort unequally... “I don’t think it’s fair. Don’t think it would be motivating... the class would be easy.”
6. Unequal weighting is unfair.
7. “...seems very difficult and confusing, It could be motivational but it’s too hard, students will give up.”

8. Unequal weighting is unfair, especially to people who are not good test takers.
9. “The point opportunity is hard and requires absolute hard work and no mess up.”

Condition 2. Possible Points = 100. (11/12 or 91.7% provided a comment)

Fairness: 3 Unfairness: 2 Difficulty: 1

1. Unfair due to unequal weighting.
2. Difficult due to unequal weighting.
3. The grading scheme has nothing to do with fairness, difficulty, or motivation.
4. Unequal weighting “could work both ways...”
5. Fair but frustrating.
6. “Extremely unfair” because some students are poor test takers.
7. Grading is fair, but a plus system (as in B+) would be more fair. (Student did not mention the fairness of minuses (as in B-).
8. Students will “feel uneasy about the course” as a senior level course.
9. The gradual increase in point value is a helpful way to gauge the course early in the course. (Counted as fair).
10. Point opportunities influence my perception (student 10)
11. Point opportunities influence my perception (student 9)

Condition 3. Five digits (10,000). (11/13 or 84.6%) Fair: 7 Unfair: 0 Difficult: 4

1. “...would be difficult but fair and is created so that students will have opportunity to gain as much information and graded fairly.”
2. Grading scheme conveyed a high level of difficulty.
3. Increasing points “puts a high amount of stress towards the student to do well on every test.”
4. Increasing points seems fair because “it will allow for students to make up points they may have lost out on while adjusting to the course.”
5. “The course should be on how hard you try.” (Fairness concerns? Probably.)
6. Fair because the grading scheme is transparent and creates clear expectations.
7. “Grading seems fair.”
8. Unequal weighting “could be challenging for students who are not strong test-takers. This is fair because

there are quizzes that increase in total points, which motivates students to stay on track.”

9. Fair because “there is a lot of opportunity to receive the grade you receive. Like you earn your grade.”
10. “The total number of points each assignment is worth vs. the total number of possible points” but did not indicate how that influenced his/her perception.

Condition 4. One digit. (4). (9/13 or 69.2%) Fair: 4
Unfair: 3 Difficult: 7

1. Unequal weighting “puts a lot of pressure on the student... especially if the student doesn’t do well on quizzes.”
2. Implication of high difficulty and fairness. Some classes require “a lot of time, effort, and perseverance but at the end they will pay off all the effort made.”
3. Unequal weighting is unfair.
4. “Fair but way difficult.”
5. Fair.
6. Motivates students to work harder but the “point structure for the quiz would discourage most students.”
7. So few possible points “will make the course more difficult than what it is. It doesn’t leave much room to mess up too much or chance to redeem themselves.”
8. “It seems that every point counts so we have to work even harder to get the best grade.”
9. Printed by hand mostly in large CAPS “THERE’S A TOTAL OF FOUR” (FOUR is underlined twice) POINTS. IF I WAS TO DO CRAPPY ON THE QUIZZES ALONE I WOULD EARN A D. THERES NO HOMEWORK, PARTICIPATON OR EXTRA CREDIT TO BOOST MY GRADE WHATSOEVER. ITS SETTING YOURSELF UP FOR FAILURE.”

Condition 5. Three digits (400). (17/21 or 80.9%) Fair: 4
Unfair: 4 Difficult: 5

1. “Quizzes are misappropriated. They should be equal.”
2. Unequal weighting implies difficulty.
3. Unequal weighting creates “a lot of pressure during the end of the year. Each quiz should be worth the same. I do not think it is fair for a quiz to be worth 80 points toward your final grade.”
4. Unequal weighting makes the course “difficult but motivating. I would have to work a little harder to earn my grade.”

5. “I don’t think it’s fair to have the quizzes be worth such drastically points. 20 points and 80 points is a huge difference and in my opinion not fair. The final grade calculation seem pretty fair and the class doesn’t seem that hard.”
6. You “must work very hard to achieve the best grade you can...”
7. “I am a horrible test taker so being that the course is made up of tests it probably would be a difficulty course for me.”
8. “...would demonstrate how much effort you put in as long as the assessments were fair questions.”
9. Unequal weighting increases difficulty.
10. A small quiz early is helpful; the midterm and final should be the same.
11. Unequal weighting influences my perception.
12. Unequal and increasing weighting implies that “the course will become more difficult... but will also keep me motivated...”
13. The lower value of the early quiz lets me “assess myself on the course to see the professor’s format and if I prepared enough.” (First impressions!).
14. Unequal weighting influences me the most.
15. Unequal weighting is unfair, “the quizzes should be worth all the same.”
16. The final grade calculation influences me the most (Student 12).
17. The final grade calculation influences me the most (Student 5).

Condition 6. Five digits (40,000). (12/16 or 75%) Fair: 2
Unfair: 7 Difficult: 6

1. The grade calculation needs more “assignments to help you practice the material and it should be graded.”
2. “I don’t think it’s necessary to have points in the thousands when it’s going to be the same percentage. I believe that the grading system seems intimidating.”
3. “How difficult the course would be if the grading scheme was based on these grades.”
4. The unequal weighting influences me the most.
5. It “will be motivating because it puts a lot of emphasis on the big exams like the midterm and final.”
6. “I think assignments such as homework, group presentations, and participation should be included in the grading.”
7. “The quizzes and exams are worth so much I assume they will be very long to make all the points. Too

- much information makes studying very difficult. Quizzes aren't worth equal points..."
8. "The amount of points one has to earn in order to get a good grade suggests that the course will be difficult but at the same time bring great knowledge to students and help students to actually bring up their grade."
 9. I don't think it is fair to be graded completely on tests. Not everyone is a good test taker. As far as the points go, the big numbers may scare some people away.
 10. Unequal points, especially the total of $30 + 30 = 60\%$ means your "chances of doing well is decreased by 12000 points."
 11. Few assignments imply difficulty "You must do well on all the assignments (cannot skip one) or grade will significantly decrease.
 12. The increasing value of quizzes.