EXPLORING THE USE OF HUMOR IN ENHANCING PHYSICS EDUCATION AND ASSESSMENT

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Abstract:

Physics is perceived as a course which students fear. This fear or anxiety is heightened even more in a testing situation in which the scores students receive have the most tangible impact on their academic career. Additionally, added anxiety and fear can often prohibit students from performing their best.

As a potential answer to this problem, a comparison of means two sided t-test was used to determine if humorous test items made a statistically significant difference in improving test scores compared to identical tests with no humorous entries. In addition a questionnaire was given to determine the students perceptions of humor benefiting them in a testing situation.

In all, four experiments were performed, three in the physics class and one in an introductory algebra

class. This study used humor in the title of the test, the directions, the questions themselves and a last page conclusion. Also, physics related cartoons were added. The author analyzed both the actual performance of students in the assessment process along with the student's perceptions of humor relieving anxiety and helping them to perform their best. While the results of using humor showed no statistically significant increase in the testing scores, the students' perception of using humor was significantly positive and encouraging.

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CHAPTER I

INTRODUCTION

The world we live in is becoming increasingly dependent on science and technology. Our accumulated knowledge about the universe we live in is doubling at staggering rates. Never before has science and math been such an important topic of study and research in America. These subjects are also crucial if America is to stay competitive with technological advances in Asia and Europe. Sadly, student enrollments in science and math classes are still low. According to a study by the National Center for Education statistics, only 3.9% of American ninth grade students will continue their education with a bachelors degree in science and less then one percent will go on for their Masters or Doctorate in science.

How can we continue to develop and advance technology here in America and stay competitive abroad when most students have a negative impression of science even before entering high school? Of all the sciences, physics is perhaps the most fundamentally important as well as the most feared and generally accepted as the most difficult. Consider that in high school, students must take biology and chemistry before even eligible for taking physics and

some high schools in America do not even offer a senor level physics course. Williams (2000) hinted at part of the problem and reasons that students fear taking physics. This study revealed that most high school science courses (other then physics) are largely based on memorization while physics deals more with quantitative skills and seeing connections and relationships between various concepts. So the approach students use to become successful in biology chemistry and all other courses included, may not work to understanding and performing well in physics. Mallory (2004) performed a study at the College of William and Mary that validated the aforementioned fears students perceive with physics. His survey based study of 191 students at William and Mary revealed another reason that students fear physics. He found that the main cause for the high levels of anxiety students associate with taking physics was that fellow classmates would relate the very high degree of difficulty required to understand and do well in a physics class.

This fear, which starts in high school, becomes even greater for students taking college physics mainly because most students who take introductory physics in college either did not take physics in high school because it was either not offered or it was just offered as an elective

not required for graduation. (This has been the authors experience teaching college physics). Therefore, taking a class one has never taken before which has a reputation for being very difficult will naturally create a high degree of fear and anxiety in many students.

Figure 1 shows that although the enrollments in physics have very slightly increased since 2000, looking at the last 30 years there is really no substantial increase from the fact that physics graduates are about 1% of the total academic degrees awarded and less than 1% of the total four year degrees awarded (academic and career combined). This is also consistent with enrollments in introductory physics courses by non-majors (according to the American Institute of Physics).

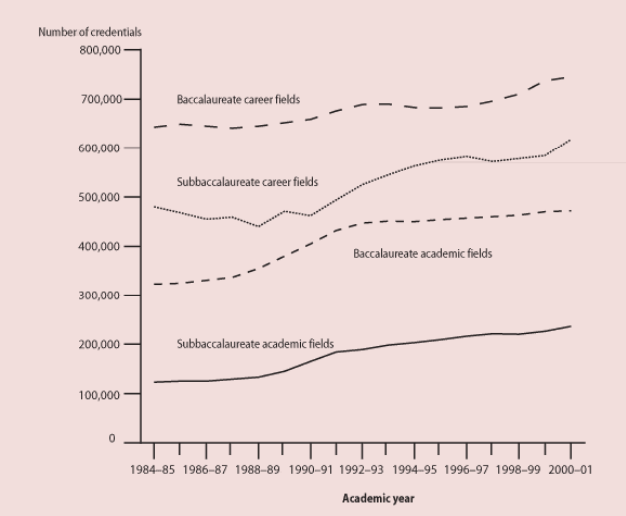

Figure 1

Physics enrollments during the last 30 years.

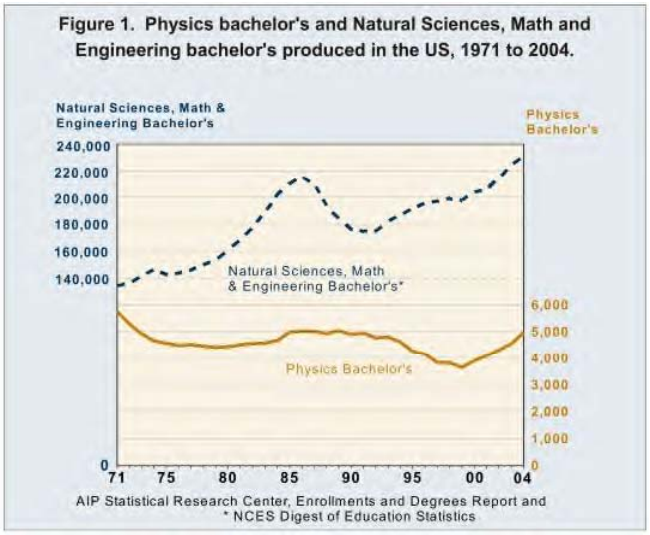

Figure 2

Number of physics bachelors degrees awarded 1971-2004.

So here is the problem the author of this research wishes to address: How can teachers of physics reduce the student's anxiety and fear of physics? And, if this can be successfully accomplished, could more students be attracted to not only taking physics courses but also consider a major or career in physics or physics related disciplines (ie engineering)?

An article by McGinn (2000) entitled "A Difficult Formula: Math = Fun" gives a possible solution to a similar problem with enrollment (occurring in mathematics). At Williams they graduate 8% of their students with a degree in mathematics while the national average is around 1%. This is even more interesting considering that Williams is

a liberal arts college. Not only does Williams have 12 math professors that have been named the countries best, but they even have a stand-up comedian named Edward Berger who was a finalist as the one of the country's best collegiate math teachers. In the 70's and 80's Williams had enrollment problems (in mathematics) like most schools but Colin Adams (the Mathematics—department chair elected in the 90's), changed the approach making math fun which is why he hired many gifted educators and even the aforementioned comedian. In fact, Adams himself has been known to dress up as a used car salesmen and incorporate humor in his own classes.

The numbers speak for themselves which gives rise to the following questions: Could this approach be equally as successful in physics? Could using Humor increase interest in physics and concurrently decrease anxiety? Finally, can humor be successfully used in a physics testing environment to improve performance?

In the next chapter, the author will summarize part of the substantial research in humor and the evidence for exploring its use in physics.

CHAPTER II

REVIEW OF RELATED LITERATURE

The author will first explore three prevalent theories of humor and why people laugh followed by the physiological and psychological benefits derived from humor and laughter, especially as related to reducing anxiety and improving learning and comprehension. From this it will be seen where humor research in education had its roots and beginnings and why humor is particularly suitable for enhancing creativity and performance in problem-based learning (PBL) courses. Finally, the author will survey the use of humor in the testing situation (or assessment) which then will be the basis and for original research in physics teaching and assessment. To summarize: the use of humor in a physics classroom to augment learning is supported by evidence that humor reduces anxiety and tension, enhances creativity and problem solving abilities and improves the students subjective experience of testing and assessment all of which are applicable to understanding and enjoying physics more thoroughly.

The past three decades has seen a dramatic increase in the amount of research on humor and its physiological, psychological and sociological benefits. These benefits

provide a foundation for using humor in the classroom or any educational or learning environment. The author will begin by summarizing the historical use of humor and why we laugh followed by an analysis of the published studies of humor and its physiological and health benefits on the body and the psychological and sociological benefits of humor. The research using humor in education is multifaceted and draws upon the aforementioned benefits of humor to create a relaxed, playful, fun environment that engages the students and enhances the learning process. Based on the ample research of using humor in education and especially its ability to reduce tension and anxiety, increase creativity and improve memory and problem solving abilities; the author of this thesis presents hopefully convincing and justifiable reasons for including humor in physics education especially with regards to testing and assessment.

In reviewing the history of humor and why we laugh, this author begins by looking at the etymology of “humor”. It is a word with several meanings but derives from the latin word *umor,* meaning liquid or fluid. In the Middle Ages, humor referred to an energy that was thought to relate to a bodily fluid and an emotional state. A sanguine humor was cheerful and associated with the blood. There was

also the humors of phlegm, choleric and melancholy. In modern dictionaries, humor is defined as “the quality of being laughable and comical” or as “a state of mind, mood and spirit.” Before looking at the benefits of humor, it is helpful to explore why it is we laugh and some historical and recent antidotes related to humor.

There are generally three accepted theories of why we laugh: The “superiority” theory, the Freudian Theory and the Incongruity theory with the latter being perhaps the most accepted.

Plato was the first to advance the “superiority” theory and it is known that he was not a fan of laughter. He felt it was wrong to laugh at the misfortunes of others and commented that laughter involved a loss of control that made one to appear less than human. So why is it that we laugh when someone slips on a banana and falls, gets a pie thrown in their face or looks silly or stupid in any given situation? Well according to this theory, we laugh because it makes us feel superior to other people. This theory also explains why we laugh at certain jokes that involve certain ethnic groups, occupations, gender, etc. If this were the only reason why we laughed, perhaps Plato would have been correct in his logic. It should be emphasized that this form of humor has NO place in the classroom.

Freud's theory on humor has similar origins to his theories for the psychology and of man, to wit that we all have sexual and aggressive thoughts and society does not allow us to express these ideas in public. As a result they become repressed into our unconsciousness and emerge in dreams, 'Freudian slips' and certain forms of psychotherapy.

So to Freud, humor and laughter was a socially acceptable way to release these otherwise unacceptable thoughts and ideas. Thoughts about death, sex, marriage, authority figures, certain bodily functions, or anything that is socially unacceptable to say with a serious tone of voice. To Freud, humor provides a kind of relief, a way to break out of the social norms and restrictions. That is, humor can give one a sense of greater freedom of expression with ideas that are normally not socially proper to express. Interestingly, Ziv (1983) explored the use of humor in increasing creativity scores. His idea was that humor allowed students to "think outside the box" and play with new ideas that are in alignment with Freud's ideas. This ability of humor to increase creativity will be explored more later in its pertinence to education.

The last and perhaps most accepted form of humor is the Incongruity theory first proposed by the famous German

Philosopher, Immanuel Kant. The idea with this theory is that we laugh at jokes because they surprise us and often seem out of place. For example its funny that clowns have ridiculously large shoes, politicians have long noses and unusual events like animals talking take place.

But there is more to this popular theory of laughter. Raskin (1985) proposed the basic structure of incongruous humor which is also called 'contrast resolution'. It consists of mainly two parts. An expected content followed by an unexpected twist. The expected content is familiar information that one can relate to. The unexpected content or punch-line, as it is often called, consists of a ridiculous and very unexpected outcome. The following joke illustrates this basic structure:

> Two fish in a tank
> One turns to the other and says: "Do you know how to drive this thing?"

The first sentence is the expected content, in this case two fish swimming in a fish tank. This relates to our everyday world where fish swim in water. The unexpected twist or punch-line reveals the double entendre of the word tank. Once the reader understands this and visualizes two fish actually driving an army tank, this unexpected outcome that is outside of the reality and ordinary life causes one to laugh according to this theory.

Laughlab (2002) carried out Magnetic Resonance Imaging of people listening to jokes. They found that there is a very specific part of the brain used to understanding why a joke is funny. Their research suggests that this area is what biologists call the prefrontal cortex.

But most importantly with regards to the current thesis, this basic structure of humor is very similar to problem solving which is why problem solving based courses seem to respond better to humor treatment than classes that involve memorization. This is a very important point that further justifies and validates the exploration of humor in the physics classroom and assessment. This point will be explored in more detail in the educational part of the literature review.

Before relevant research of the use of humor in education and specifically physics education is discussed, the physiological and social-psychology benefits will be succinctly presented. This sets the foundation and justifies the use of exploring humor in education. First the physiological and health promoting effects will be looked at which includes significant research in the medical field on the benefits of humor to help prevent and reverse disease. Next the general psychological and social benefits will be presented which then logically foreshadows

the possibilities in education.

The idea that humor and laughter can reduce pain and even reverse disease was made popular in a peer reviewed research paper published in the New England Journal (later to become a best-selling book) by Norman Cousins entitled, *Anatomy of an Illness (As Perceived by the Patient).* He suffered from a serious collagen disease that resulted in severe inflammation of his spine and degeneration of his joints, tendons and ligaments. Given only a 1 in 500 chance of recovery, Cousins surrounded himself with jokes and humor and was known to watch the “Marx Brothers”, “Candid Camera” reruns and the Three Stooges. He even began a humor treatment program on himself and recounted (p 39) that “10 minutes of genuine belly laughter had an anesthetic effect and would give me at least 2 hours of pain free sleep. When he woke up with pain again, he would continue his “humor treatment” until the pain was gone and could again sleep some more. He continued this “humor treatment” until after a few weeks his pain was almost completely gone and his doctors found that his connective tissue was regenerating. Soon after he went back to work full-time and experienced a full recovery within a couple years (Cousins also took mega doses of vitamin C but attributes his recovery mainly to humor).

Cousins' (1979) book and research spurred attention and subsequent research in the medical community. Besides pain relief, other physiological benefits of humor that have been researched include (but not limited to) improved respiration and oxygen uptake (Fry 1994), benefits to circulation similar to aerobic exercise (Fry 1994), increase in immunity, decrease in stress hormones such as cortical and perhaps most important to this author's research is the research on humor showing improvement in mental functioning. Though a decrease in stress hormones is also important and we will further explore this when we get to the psychological benefits.

The relationship between creativity and problem solving has already been briefly mentioned. The importance of the linkage between humor and right brain hemisphere activity such as spatial reasoning and recognition is grounds for justification for its use in problem solving based learning activities (more later in this paper). However, there is actual direct physiological evidence that has found that laughter increases catecholamine levels in the body, which actually improves overall mental functioning (Fry, 1984). This neurotransmitter is needed for alertness and memory.

Also, O'Keefe and Teresi (1986) documented the work of

Dr. James McGaugh who says, "Arousal [through laughter] causes all these chemical cocktails-morepinephine, adrenaline, enkephalin, vasopressin, ACTH to spritz out. We think these chemicals are memory fixatives...they signal the brain, this is important, keep this!" Also established was the role of the hippocampus in emotions and learning and suggesting that “positive emotions allow the brain to better manufacture cognitive maps”. Paul MacLean (1978) further supports that our hormones, feelings, and emotions affect our learning.

According to the research of McNamara and Skelton (1993), there is specific neurochemical basis for learning and memory. Finally, Stanford researcher, Badura (1986) notes that there is a biochemical difference in the body when a person is confident and optimistic. The presenter's job is to assist students in deliberately releasing those chemicals through emotional release, physical movement and positive attitude. In other words, the teacher's job is not to teach, but to provide an environment that is conducive to learning.

This brings us now to the sociological and especially psychological benefits of humor especially as related to learning and a better educational experience. There is much overlap between the psychological benefits of humor and the

brain chemistry benefits as the two are unavoidably connected. This next section will deal less with brain chemistry and more with pure psychology and sociology.

Kline (1907) summarized the psychological benefit of humor:

> To detach us from the world of good and evil, of loss and gain, and enable us to see it in proper perspective. It frees us from vanity on the one hand and from pessimism on the other by keeping us larger than what we do and greater than what can happen to us (p 438).

That is, humor helps to raise us above our current problems and circumstances and offers a new perspective that might not have been seen. The best example is a story that was rumored to happen at a past United Nations summit during the Cubin Missile crisis. Even if the story is not true, it still illustrates the authors point. As the tension of the summit was mounting and the threat of war was very high, a Russian delegate with a smile says, “In capitalism, man exploits man; in Communism it is the other way around”. This joke had a magical effect of breaking through the tension and opening communication. That is, it helped all the delegates for just a moment detach from the problem and see it from another perspective.

The function of humor as a coping mechanism to stress is well supported by some of the most well respected and famous psychologists of our time. Freud himself said that humor is “the highest of [the] defensive processes (Freud, 1959, p 216).

Berk (2002 pg 41,42) outlines the psychological process of humor as one of problem stimulus, humor response, and emotional response. In the classroom, the problem response could be a test, quiz, difficult grading system, difficult project, etc. The Humor response is the detachment resulting from the use of humor and seeing the humor in a difficult situation. The emotional response is a distancing from the problem though the use of humor and results in the natural suppression of negative emotions that would normally arise. Even psychologists use something called “paradoxical therapy’ on patients who are really “stuck” in their problems. The strategy is to exaggerate the problem (hyperbole) to such an extent that laughter results and the patient can see the humor in their problem.

As we have already seen the fear and anxiety attached to students perceptions of physics; in this light, humor could be a very effective coping mechanism to allay the fears and stresses of physics and other difficult courses.

The social benefits of humor in the classroom have

established that humor overall seems to increase teacher ratings with students and also create a better student-teacher relationship (Bryant 1980). Also it was found that teachers who used humor were found to me more approachable by students.

Finally this paper will explore the educational specific research for using humor in the physics classroom, especially with reference to assessment and testing situations which is the basis for the original research done by this author.

There are two primary reasons to explore the use of humor specifically in a physics classroom. The first has to do with the aforementioned perceived fear and anxiety students have of physics. In light of the evidence presented that humor helps to both physiologically fight stress hormones and psychology help to detach and cope with stress, this alone would warrant further exploration in using humor in a physics class. This is also the primary reason to include it in a testing situation. Even more interesting is returning to the incongruity theory, the isomorphism in the brain between understanding a joke and solving a problem. The author of this paper introduced this idea earlier in this literature review and now will proceed to further explain this similarity between understanding a

joke and problem solving.

The actual mental process of humor involves the right hemisphere of the brain (Svebak, 1982) and is, surprisingly similar to the process of creativity, (Ziv, 1983) and problem solving (Johnson 1990). Especially of interest to the current study is the connections between understanding a joke and problem solving, because there is evidence to suggest (Berk 2002) that using humor in the classroom is especially significant in problem-based learning (PBL) courses and not as effective in course that involve pure memorization. So it turns out that using humor in education may be justifiable only in (PBL) based courses such as math, physics and engineering. The congruency between problem solving and humor can be seen in two stages (Berk 2002). The first is the "recognition of the incongruity in the humor which resembles *identifying the problem."* The second stage is the "resolution or understanding the punch line which is akin to *solving the problem*." Electrophysiological research suggests the second stage mentioned above involves the right hemisphere of the brain. So because humor and problem solving require the same mental process, "one can prime the other" (Berk 2002). Berk concludes that there is sufficient evidence to warrant the use of humor in PBL based courses and courses requiring

creative thinking and right brain activity.

So now the author concludes this literature review with the research specifically pertinent to the original research presented; to wit, the use of humor in testing and assessment. In light of the research that humor reduces anxiety, tension and stress on both the physiological and emotional level, it is obvious why humor in a testing environment would helpful to students. No other time in the semester do stress and tension levels rise to the levels they do in a testing situation. The future of the student is dependent somewhat on how well they perform.

The literature research on this topic is limited yet there have been studies done (Berk 2000) that justify the further exploration of this area of humor research. The two main facets of this topic are, first, the fact that humor reduces anxiety as perceived by the students and second, the use of humor to improve test performance. Because this current thesis has established the role of humor in both learning and stress management, there is certainly copious evidence to support further exploration.

The current available research of humor in a testing situation to improve performance is limited and actually not very encouraging. McMorris (1997) rigorously studied the effects of humor in a testing situation. This study was

done in an undergraduate psychology class with multiple choice questions, with humorous choices and cartoons. The study concluded that there was no significant evidence to suggest that humor improves test scores, but the students perception was in favor of humor. So there appears to be no conclusive evidence that humor improves test scores, but there is positive evidence that it reduces anxiety. Further, there is no research on the use of humor in a physics-testing situation and based on the evidence for using humor in PBL courses, I think there is sufficient justification for exploration.

There have been at least two studies reporting positive evidence that humor reduces anxiety and stress in a testing situation by both Smith (1971) and Hedl (1981).

But the most thorough and convincing study was one by Berk (2000) who took a different approach and designed a study to test the students "perceptions" of humor reducing anxiety and stress and helping students to perform their best. Based on the responses of 695 students enrolled in six undergraduate introductory statistics courses and eleven graduate courses, Berk (2000) found that the median class ratings of students' perceptions of the effectiveness of humor ranged from *Moderately Effective* to *Extremely Effective* for "reducing test anxiety", and "performing your

best". For "reducing test anxiety" Berk found the highest effectiveness rating, *Extremely Effective*, was found in a majority of students in both undergraduate and graduate classes. These results are consistence with the aforementioned research that humor reduces anxiety and stress. The author of this thesis will attempt (in two experiments) to replicate Berk's findings (See the experimental section of this paper for details on the questionnaire used).

Berk concludes that although the research he conducted was based on self-report data, it is significant for (paraphrasing Berk) at least three reasons. First it shows that students perceive that humor reduces their anxiety levels and helps them to perform their best. Next, this effect was consistent over time (six years) for 17 different samples, and finally the effect was generalizable across undergraduate courses, day and evening courses and a variety of class sizes, students and exam formats.

So hopefully a convincing argument has been portrayed justifying further explanation in the area of physics education. The author found no research done in a physics classroom on the use of humor, so the research presented is, in the authors opinion, original and with merit. The two-fold main justification in a physics classroom is the

fear and anxiety that student perceive in taking physics(and humor's allaying effect on them) along with the congruity of problem solving nature of physics and the brain's processing of humor.

Chapter III

PROCEDURES

In this section of the thesis, the author will provide the framework for the four experiments that were conducted. The first two experiments received the most rigor and included an analysis of both the actual test scores (with and without humor) and also the students perceptions of humor; while the latter two experiments solely examined if humor improved test performance relative to a control group.

An overall plan was well thought out to properly assess the effects of humor in a testing situation. The author will begin by describing the actual format of the tests that were used followed by the actual execution of the experiment. Following the ground-breaking research done by Berk (2000) mentioned in the literature review, a similar format was developed for this series of experiments.

The control group will receive a regular unaltered physical science test. The experimental group will receive the exact same test questions, but the test itself will contain: A humorous title, humorous warning for taking the test, irrelevant humorous “choice e” answers (the test is

multiple choice), humorous last page, and pre-tested Far Side© cartoons. The humorous instructions, “choice e” answers and humorous last page are from Berk (2002). These are used because they are backed up by several years of experience and success, so their inclusion in our study adds credibility and validation. So the test begins with a humorous title and perhaps even a graphic. On our first test (which was on waves) a graphic of a mouse surfing was used with the Title “Exam 3 - Surfing the Waves”. This humorous title will vary from test to test depending on the test content. The remaining humorous insertions are constant. Following the title there is the following humorous directions:

> Warning (adopted from Berk 2002):This test consists of 50 multiple-choice items. Most of the items have four choices (A,B,C, or D); however, there are several items sprinkled throughout the test with a humorous choice “E” which is intended solely for your entertainment. Any other use, such as for the correct answer, is strictly prohibited without the prior written and notarized consent of next of kin.

Then the multiple choice test begins. There was no

difference in the actual questions used by the control and treatment groups, accept the treatment group have added several humorous choice “E” answer. Examples of the answers used are listed below.

Example Choice “E” answers (adopted from Berk 2002)

1. “Who cares!”
2. “I don’t have a clue!”
3. “Do I really need to know this?”
4. “This is the only question I can’t answer”
5. “The answer temporarily escapes me.”
6. “I can’t believe you asked this.”
7. “I know I should have studied this

According to Berk using the humorous fifth choice at *uneven* item intervals throughout the test gives the student a sort of humorous reinforcement. Berk also found that overdoing the humorous choice “E” decreases its effectiveness. The students should be surprised to see these humorous answers and not expect them in every question.

The humorous test used by the treatment group included a humorous last page (adopted from Berk 2002) which stated the following”

NOTE: This was only a TEST. If this had been an actual emergency, you wouldn't be sitting here suffering through this stuff. You may now resume your regularly scheduled activities.

The fifth and final element of humor used on the test which is original to this authors research was the inclusion of physics related Far Side© cartoons. The author took great care in searching Five Volumes of Far Side Galleries for physics related humor. Twenty-four physics related cartoons were selected and then rated on a scale from one to five (1=really not funny, 5=really funny). Twenty students from the IUP physics club rated the 24 comics and some only the highest rated ones were used on the humorous tests. This pre-testing of the cartoons by actual physics students hopefully assured that the cartoons selected would be deemed as "funny" by the students in the experimental groups.

In addition to the humorous elements, the last page of the experimental groups test (for experiments one and two) also included the following Questionnaire which provided additional data as to the perceptions of each student on using humor on tests (Adopted from Berk 2002). This is

important because the literature review of actual test performance is not significantly influenced by humor, though the research of Berk (2000) and others affirms that the students' perception of humor is actually effective. The following questionnaire was used to assess the students perception of humor (in experiments one and two).

0=Strongly Disagree

1=Disagree

2=Agree

3=Strongly Agree

1.Humor in the test directions reduced my initial anxiety

0 1 2 3

2. The humorous items helped me perform my best 0

1 2 3

3. The humorous items were distracting.

0 1 2 3

4. The humorous items reduced my anxiety

0 1 2 3

5. Humorous items should be included on the next test.

0 1 2 3

This concludes the general procedure used for the experiments performed. It must be further emphasized that

all four experiments used the same testing format, but only the first two contained the above questionnaire. The latter two only addressed whether humor statistically significantly improved test scores.

In the first experiment, the method of subject selection was as follows. A stratified sample was taken from each of the four sections of an introductory physical science. Each student was assigned a label, 00-70 (assuming each section has approximately 70 students). A random number table will then be used to randomly place the first half of the students selected in the experimental group (humor on tests) and the rest in the control group (no humor). There will be no advertisement for the study.

The Characteristics of the Subject Population were as follows: The population under study was exactly 65 physical science students (both male and female) who are near equally freshman and sophomores at the Indiana University of Pennsylvania. There is no inclusion or exclusion criteria as all students will has an equally likely chance of being placed in a experimental group or a control group. This study in no way should affect vulnerable subjects.

Every effort was made to keep both tests the same length. That is, the control group will have non-humorous instructions, non-humorous choice “E” answers, a non

humorous last page and the same Questionnaire as above, only the questions will be rephrased like “Do you think humor in the test directions would reduce your initial anxiety”. “Do you think… will be added to obtain opinions from the students who did not experience humor and to keep the test of equal length. The results from this first experiment are shared in Section IV.

The second experiment took place in the Spring of 2003 in an introductory physics course for teachers and educators. Unlike experiment one which was a stratified sample of one class randomly chosen out of four, this experiment was a convenience sample of two nearly identical populations and the same class (SCI 101) taught by Dr. Stanley Sobolewski at the Indiana University of Pennsylvania. One class received humor treatment (n=20) and the other did not (n= 30) on Exam #2. The tests as in experiment one were the same, but only humorous cartoons and last page descriptor was used. In addition, humorous formulas were injected. Only cartoons receiving a high rating were used as in experiment #1. So in all there were three humorous elements and the same survey questions used in experiment one.

The third experiment involved the use of humor on a basic college algebra class. The format was similar to

experiment two in which two identical classes receiving the same lectures, only one class received humor (n=13) and the other no humor (n=11). The experiment took place in the spring of 2004 at Muskegon Community college and the students in both classes had diverse ages and majors.

The final experiment was also akin to experiments #2 and #3 in an introductory algebra based physics class. Unlike the previous two experiments in which different class sections were used, this experiment was a matched pair study using proven questions developed by Harvard researcher Eric Mazur (FCI - forced concept inventory).

Each half of the class (both n=11) was given two different versions of very carefully selected FCI questions. The questions have reputation for assessing the similar concepts in uniquely different ways. His fourth and final experiment was a matched pair test assessing both groups with no humor (before) and with humor (after). The tests were exactly one week apart in December of 2006. Initially two tests, call them version “A” and version “B” were given out on the first week. The difference in scores between the two tests was not significant (see data and analysis) validating the same degree of difficulty and similarity of concepts tested. The following week the group that had version “A” got version “B” and vice versa but now

with the addition of humorous elements. The class began, being the last day of class, with pizza and soft drinks and everyone appeared to be in a jolly mood. The teacher (and author of this paper) then told his favorite holiday joke that got a great response. The tests were administered with the addition of the same tested cartoons, but on overhead. It was clear by the number of smiles that everyone was having a good time.

The data and analysis of all four experiments are presented in the next chapter.

Chapter IV

DATA AND ANALYSIS

In chapter III, the procedures and format of the four experiments of using humor in physics assessment were outlined. This chapter will now analyze the data collected from these experiments. The author was present for all four experiments and observations and results will now be analyzed for each.

The first experiment was performed on Wednesday, November 20, 2002. The study included a diverse group of 65 students from several non-physics majors at Indiana University of Pennsylvania. A random number table was used to place 34 students in treatment group (receiving humor) and 31 students in the control group (receiving no humor). All students had plenty of time to finish and even the last student finished 15 minutes early. Observing the students during the test, the humorous test items (listed earlier in this chapter) elicited no outward response except for two or three smiles. This was unexpected, because the cartoons were successfully pre-tested with much laughter response. Based on this experience and an additional review of humor research, it was determined that humor needs to be injected in the classroom prior to the test so students have better

expectations of receiving humor in a testing situation.

A comparison of means two sided t-test is used to determine if humorous test had a statistically significant difference from the non-humorous test. Even though we are testing to look for test improvements, one cannot ignore the possibility that test scores could be lowered with humor. So the null hypothesis (H_o) is that there is no difference in the mean test scores from using humor (μ_1)and using no humor (μ_2). The alternative hypothesis (H_a) is that there is a statistically significant difference.

The tests were collected and graded and is was calculated that the mean for the treatment group (humor included) was 38.87 (out of 50) with a standard deviation of 6.79. The mean for the control group was 40.74 (out of 50) with a standard deviation of 7.18. Using statistical software, the comparison of means 2 sided t-test yielded a p-value of .29 . Even though the students receiving humor scored lower, there was not sufficient evidence to reject the null hypothesis that no change resulted, meaning the lowered test scores were not significant but rather based more on chance (due to the elevated p-value).

Even though humor did not actually improve the test scores in the control group, the questionnaire below (adapted from Berk 2000) was very encouraging. The median

an modal response for all five questions supported the authors hypothesis that students perceive humor to reduce anxiety and help students perform their best. In fact the median and modal reply for students perceiving humor to lower anxiety in both the test directions and the test itself was “strongly agree”. As the author has established, this is significant because of the anxiety and fear associated with physics. Furthermore, students did not find the humor distracting and a strong majority agree they would like to see humor again on future tests. Although the evidence does not support that humor helped students to perform better, the fact that a majority perceived humor to do so is encouraging. Table I below summarizes the results. Since a few students did not respond to the questionnaire, the percentages do not add up to 100%

Table 1. *Experiment One Questionnaire Results*

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
Humor in the test directions reduced my anxiety	0%	6%	42%	48%
The humorous items helped me perform my best	6%	26%	35%	24%
The humorous items were distracting	52%	29%	10%	6%
The humorous items reduced my anxiety	3%	3%	58%	32%
Humorous items should be used on the next test	3%	0%	35%	45%

The second experiment as mentioned in the procedure sections was divided between two separate introductory physics classes. Both groups received identical questions expect that the treatment group receiving humor had an additional five questions as used in experiment one and listed again (with the results) in table 2.

Another 2-sample comparison of means t-test was preformed identical to the one in experiment one. The null hypothesis (H_o) was again no change in test scores and the alternative hypothesis (H_a) was a change for better or worse. The mean test score for the control group (no humor) was 70.065 with a standard deviation of 10.07 (n=31). The mean score for the treatment group was 72.70 with a standard deviation of 15.519 (n=20). Using statistical software the results of the 2 sample t-test yielded a p-value of .44 which is by no means significant. However, unlike experiment one, at least the group receiving humor did score better instead of worse.

Although there was again no statistically significant evidence that humor helped students perform better, the table below shows that once again, the students perceptions of humor was favorable. In every question the median and modal response was that the students “Agree” that humor helps to reduce anxiety and perform their best and also

that students “agree” that they would like to see humor again on the next test. Also as before, students disagreed that humor was distracting.

These results are very much in alignment with the research of Ron Berk at Johns Hopkins where identical questions were answered. Interestingly, Berk also did not have any objective evidence that humor actually improved test scores, only that students perceived humor as such. But perhaps even more significant, was that students very convincingly perceived humor to reduce anxiety that is so commonplace in a testing situation.

Table 2. *Experiment Two Questionnaire Results*

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
Humor in the test directions reduced my anxiety	0%	10%	65%	20%
The humorous items helped me perform my best	10%	30%	50%	5%
The humorous items were distracting	10%	75%	5%	5%
The humorous items reduced my anxiety	5%	25%	55%	10%
Humorous items should be used on the next test	10%	5%	65%	15%

The third experiment in this study was not physics but an introductory college algebra class, the same format was used as in experiment two with two separate classes being

used and humorous cartoons and conclusion (along with title and directions) added to the treatment group. The author chose a math-based course out of convenience and the fact that no physics course was offered. The control group achieved a score of 77.91 with a standard deviation of 14.69 (n=11). The treatment group achieved a score of 83.36 and a standard deviation of 12.17 (n=13). Using this data and calculate a two tail t-test (comparison of means) statistical software revealed a p-value of .33 which again is not significant though more interesting than the previous two experiments.

The fourth and final experiment was a matched pair comparison of means t-test. But first two different version of conceptually nearly identical questions (Mazur) were tested to assure similar degrees of difficulty. Two versions “A” and “B” were distributed to each half of the classroom (n=11 on both sides). The difference of means was nearly identical. Using statistical software to test for a difference yielded a p-value of .34 which is not sufficient evidence to suggest that one test was harder than the other.

Exactly one week later the half of the class that received version “A” now got “B” and vice versa for the other half. But this time (as mentioned in the procedure

section), a small party was given, a few jokes shared and humorous cartoons used. A matched pair comparison of means test (before and after) for the first group (the mean before was 8.36 and the mean after 8.63 - out of 15). This results in a p-value of .37 (null hypothesis no change - two tailed). The other group improved from a mean of 7.18 to 8.63 with a p-value of .21.

Though the final two experiments marked a greater confidence of improvement, nonetheless, the results are not convincing. But the author is encouraged and pleased by the students perceptions of humor outlined in the first two experiments.

Chapter V

CONCLUSIONS

Based on the voluminous research that humor has a beneficial impact on improving human physiology, psychology and even pedagogical processes, the author became intrigued and interested to extend this research into physics education. It was after reading a paper by O'Keefe stating that humor improves the ability to make cognitive maps, that the first sign of proof showed itself to the author which began this current study.

Although the research on humor's ability to alter human physiology, psychology and even different facets of learning; ability of humor to actually improve test scores is severely lacking evidence in published literature. The studies that have been performed (as stated in the latter part of the literature review) were inclusive and even somewhat discouraging. However, based on the meticulous and inspired research of Ron Berk at John's Hopkins, a new approach to studying humor in assessment was researched. This approach has to do with the students subjective perceptions to the use of humor in a testing situation. It is well known and perhaps obvious that student anxiety reaches its height in and around tests and assessment. The

subject questionnaires used by Berk over a six year period and hundreds of students across all levels, ages and majors, unanimously came to a resounding and clear conclusion. Students perceive humor to be helpful in reducing anxiety and help them perform their best. Though subjective questionnaires may not be as convincing as actual objective improvements in scores, if the students perceive it as beneficial in reducing stress and anxiety, than that alone should warrant additional research and acceptance by educators. For as an educator, if the learning process can be made more fun and less stressful, than we have performed a valuable service to our students who are the future of this country and the world.

The author's four experiments in humor were in alignment with published research. That is, although objective evidence was lacking to show that humor actually improved test scores, the subjective questionnaires were very much in alignment with the research of Berk (2000). In the two experiments performed with questionnaires in this current study, the modal and median responses were conclusive in supporting the premise that students perceive humor to reduce anxiety and perform their best. In addition, students also did not perceive the humorous items to be distracting and even wanted their next test to

include humor.

It is the hope and desire of this author that all teachers and educators will explore the use of humor in the classroom and on assessment if for no other reason than to make learning more enjoyable and less stressful on the students.

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Appendix A

Math And Physics Jokes

Math jokes

1. Old Mathematicians never die; they just lose some of their functions
2. A Math professor is one who talks in someone else's sleep
3. 79.48% of all statistics are made up on the spot
4. Statistics is like a bikini; what they reveal is suggestive, but what they conceal is vital
5. Did you here about the trigonometry teacher who developed amnesia and lost his identities
6. Yesterday, I heard a joke about decimals, but I didn't get the point
7. What is 5Q+5Q? 10Q, you're welcome
8. Don't drink and derive
9. Lottery is a tax on people who do not understand statistics
10. Recent polls suggest that 3 out of 4 Americans make up 75% of the population

Physics jokes

1. In Fairbanks Alaska you can get 40 below on a test.
2. They just discovered room temperature superconductivity in Fairbanks, Alaska
3. A neutron walks into a bar; he asks the bartender, "How much for the beer?" The bartender looks at him and says "For you, no charge"
4. Heisenberg is out for a drive when he is stopped by a cop. The cop says, "Do you know how fast you were going?" Heisenberg replies, "No, but I know where I am.
5. "A student recognizes Einstein in a train and asks, "Excuse me professor, but does New York stop by this train
6. Everything is relative and relatives take all your things
7. Physics is like sex, sure it may give some practical results, but that is not why we do it(Feyman)
8. "Heavier than air flying machines are impossible" Lord Kelvin 1895 President Royal Society
9. If you make an apple pie truly from scratch, you must first invent the universe." (Carl Sagan)
10. The study of non-linear physics is like the study of non-elephant biology