Impact of Learner Interest on Active Learning Outcomes

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Abstract

The usage of active learning techniques has been shown to improve student engagement with the material as well as academic performance outcomes. A component of these techniques' effectiveness may come from their ability to create intrinsic motivation in students. Like active learning itself, a student's self-efficacy and intrinsic motivation towards learning are strongly correlated with both engagement and academic performance. This study further investigates the relationship between intrinsic motivation and the effectiveness of active learning techniques by looking at the impact of existing motivational factors. To examine this relationship, 20-30 current students will be asked about interest in a particular subject area and then given a text to study using an active or passive technique. Their scores on a short test of the material will be compared to ratings of interest.

Keywords: Active learning, Intrinsic motivation, Online instruction

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Both active learning and intrinsic motivation have been linked with increased engagement leading to better academic achievement. While active learning techniques can help foster some of this intrinsic motivation it is unclear what role existing motivational factors play in moderating this effect. It may be the case that students who are already motivated to do well in a class will be engaged and receive less or no benefit from any additional motivation from active learning. It is also possible that each student receives equal benefit from the usage of active learning regardless of existing motivation. This study investigates what effect existing intrinsic motivation plays on active learning outcomes.

The term 'active learning' is used to describe activities in which students are engaged in the learning process through higher order thinking tasks. Active learning can take many forms but is typically seen in activities that require analysis, synthesis, or evaluation of course material(Bonwell & Eison, 1991). At the base level, activities that contain a small amount of active learning such as question & answer, formative quizzes, or Free writing help to involve the student in the learning process. However, there is not much room for critical thinking, and these activities are mainly used to check for understanding. Activities that have a moderate amount of active learning such as Concept maps, peer teaching, role-playing, or Pro-Con grids require students to rearrange and connect information in ways that make sense to them. Activities in this category are all individual active learning tasks, where the direction is determined by students to help themselves learn. Of these, concept maps, where nodes of ideas are categorized and linked together to form a web of connections, are the highest rated of the individual tasks. Activities rated high in active learning such as Jigsaw, Cooperative Learning, or Cooperative Cases, make the addition of adding student collaboration to solve unique problems related to the course

material (Amburgh et al., 2007). During active learning, the instructor gives guidance and direction to the learner so they may create their own knowledge and build understanding.

Passive learning is often given as a contrasting set of techniques to active learning. Rather than being centered around student participation with the material, in passive learning the instructor transmits their own knowledge and understanding to the student. The lecture is the most common and pervasive passive learning technique as it provides direct and efficient means of transferring knowledge from instructor to student. Lectures serve a key role in combining and sequencing material that may otherwise be unavailable or out of the students' current understanding. However, these techniques often absolve the student of their responsibility to participate and take part in the learning process (Nasmith & Steinert, 2001). One consequence of this style is that it often results in student utilizing short term memorization of material rather than developing longer lasting memory structures. Additionally, while passive learning allows instructors to convey large volumes of information in a limited time, this dumping of information can leave students feeling overwhelmed with little time to fully process the material (Smith & Cardaciotto, 2011). Ultimately, passive techniques are a good option for larger classes where the goal is to simply convey information, but the benefits of active learning should be considered when deciding how to best help students learn.

Students that participate in active learning are found to be more engaged with the topic during learning and achieve better academic outcomes (Anaya, 1996). When given the same material to learn, students who are taught with an active learning approach show better retention of the material and report greater engagement with that material. Smith and Cardaciotto (2011) suggest that this is likely due to the increased intellectual effort required by a more active learning environments and may also show diminished effects if challenge is too high.

Engagement has been viewed as one explanation for the success of Active learning in bettering academic outcomes. On its own, greater levels of engagement have been linked to academic success, often reflected in better attention and focus in the classroom. Engagement itself can be characterized psychologically by a sense of purpose, academically by staying on task, and emotionally through enjoyment of the activity. While leading to improved academic performance, engagement is an outcome of many other factors including a student's social context of family, friends, and teachers in addition to their self-efficacy (Upadyaya & Salmela-Aro, 2013). Active learning is not the only way to increase engagement, intrinsic motivation also plays a role, either on its own or through active learning.

Interest is a subjective arousal towards learning and a desire to learn more about a subject. In models of domain learning there is a distinction between the trait and state of interest. The trait of interest is individual and subjective, relying on predisposition and existing knowledge concepts. This can be seen in people with long term investments towards a particular goal or chosen field of study. The state of situational interest is generated more by focused attention to the immediate environment, primarily the task content (Ainley, 2006). A student's motivation is independent of previous achievement or motivation, often varying between classes or lessons. A student who is intrinsically motivated to learn about one subject may require the use of active learning to stay motivated when learning about another (Pintrich & De Groot, 1990).

A student's self-efficacy and intrinsic value they find from the material are strongly correlated with both engagement and academic performance. Creating that intrinsic motivation is key to keeping students engaged and interested in the material. Pintrich and De Groot (1990) found that students with higher self-efficacy and intrinsic motivation were more likely to persist

when faced with difficult academic challenges and reported higher usage of cognitive strategies. Usage of cognitive strategies shows that students who are motivated to learn may already be engaging in active learning outside of class in order to perform better academically. These results also suggest that teaching of these cognitive strategies may also help to improve academic performance.

These effects can vary from student to student depending on their academic goals. Ratings of interest and engagement have been linked to students whose focus is on developing their own skills and knowledge. These students who focus on demonstrating competence through mastery see this correlation with interest, however this is not observed for students whose focus on demonstrating competence is only relative to others. These students who are driven more by performance goals and showing off their skills are still likely to find academic success, despite not being interested or engaged in the material. A final group of students who adopt work avoidance goals and focus on minimizing their effort show similarly low levels of interest and engagement (Harackiewicz, 2002). Since the goals of each individual student influence both their interest in the material and academic achievement in different ways, it can be difficult to find a link between the two.

DeMarie and Alosise-Young (2003) demonstrated that students have an interest in their chosen major and understanding the vocabulary of their chose field, with not a single student in their survey indicating disinterest and the most common answer being the greatest rating of interest. Regardless of degree program or college, interest in the program is consistently rated as an important factor when selecting a Major. Even students in their first year of study favor learning about their own major over others. In fact, college year has no significant effect on a student's level of interest.

~~One approach to active learning that demonstrates its ability inspire intrinsic motivation is educational games. In these games, achievable yet challenging goals, often in the form of a score, are the most motivating factor for students in continuing to play (Malone, 1981). Huffaker and Calvert (2004) found that when children play educational games or construct their own, they become more intrinsically motivated, play for longer, and subsequently learn more. This intrinsic motivation is seen when children show desire to play the game when it is not required of them, leading to increased time spent playing the game and learning outside of the classroom. Games that included more choice were also shown to play a role in creating enjoyable experiences for the learner. This was seen in games that did not explicitly tell the learner what action to take or how to solve a problem similar to how active learning would function in a classroom setting.~~

Active learning and intrinsic motivation appear to influence each other with active learning helping to inspire intrinsic motivation and intrinsic motivation leading to the usage of active learning techniques outside of the classroom. Still, both have been shown to better academic outcomes by improving a student's engagement with the material. In the initial learning of the material however, it is still unclear what the relationship is between active learning and student interest (with interest being a student's intrinsic motivation to learn).

Hypothesis

To investigate the effects of existing motivation this study compares student interest with their academic achievement when using active or passive learning techniques. The association between a student's intrinsic interest in a subject and academic performance indicates that students who are already interested in the material will achieve the same in both the passive and active learning conditions. The ability of active learning techniques to create this intrinsic

interest indicates that students who are not already interested in the material will achieve more when active learning techniques are used compared to passive techniques.

When taken across a range of interest levels, this leads to the main hypothesis of this study: a student's interest in the material will have a positive effect on score in the passive learning condition but have no effect in the active learning condition.

Methods

Participants

Up to 60 undergraduate students from the Rochester Institute of Technology were recruited using a standard message. As a stand in for learner interest, half the participants were recruited from Psychology majors and the other half were recruited from Game Design & Development majors. Participants were recruited through the SONA system and received SONA credits if they were enrolled in a Psychology class that accepts credits for research participation. Social media was also be used to recruit, with the incentive of entering into a $50 gift card raffle. To avoid any age-based learning effects, all participants were aged 18 – 25, the typical age of most undergraduate students. Participants from both major groups were randomly assigned to either the active or passive learning condition in an attempt to minimize the effects of any other demographic factors.

Materials

Kelly McGonigal's 2013 TED talk on *How to make stress your friend* was selected as the material to learn due to its duration of around 14 minutes and its psychology related subject matter. When choosing the material, it was important to pick a topic that creates distinct groups

of student interest. The main consideration here is the likely bias towards the interests of psychology students who were easily recruited.

Allowing participants to pause the video where needed introduced a confounding variable of time spent learning. To allow for tests of significance a phone timer was used to measure the time it took participants to watch the talk. The timer was also be used to keep track of the time between learning and quiz to maintain consistent spacing of these activities between participants.

A 10-item quiz was developed based on key points and themes from the talk to measure how well participants were able to understand and retain the information presented. Each of the items will is a multiple-choice question with 4 possible choices, one of which is correct. Multiple choice questions were used in order to remove any interpretation or bias when scoring, which is calculated as the total number of questions answered correctly. Trial runs were conducted before the experiment to determine the difficulty of the quiz with the intent of providing some questions about general themes along with some questions about specific effects or statistics.

Procedure

The experiment began with a short introduction of the material and a description of the active or passive learning technique they will be using. Students were then asked to rate their perceived interest in the talk on a Likert scale [Appendix A]. This rating of interest was taken before students watched the talk to avoid interference of interest generated by their learning technique. Ratings of interest were expected to vary between the Psychology and Game Development majors since the topics covered pertain more to the field of psychology.

Participants in the active learning condition were then asked to create a concept map while watching the talk. As mentioned earlier, Amburgh et al. (2007) indicate that peer-to-peer and cooperative learning experiences are the most effective activities for active learning, but

given current limitations to in-person activities, this study uses the highest rated individual learning technique: concept maps. To ensure that all participants in this condition were able to use concept maps effectively, a description and image were provided to them before watching the talk, along with time for asking questions [Appendix B]. Participants in the passive learning condition were explicitly asked to not take notes while watching the lecture. Although it was not expected for students to take notes on their own, the involvement of a quiz may have led students to employ their own learning techniques. Participants in both conditions also had the option to pause the video at any time, whether to complete a section of their concept map or spend time thinking. The time taken to watch the video was recorded for each participant.

After completing the learning portion of the experiment, participants were asked to provide some basic demographic and academic information. This included items such as: gender, age, academic year, major(s) and minor(s). At this point, participants were again asked to rate their interest in the material for comparison to initial ratings of overall interest [Appendix C]. The time spent collecting this information served to fill a brief buffer between the learning period and quiz (5 minutes between the end of learning and start of the quiz).

Once the demographic information was collected and 5 minutes had passed, participants were given the 10-item multiple choice quiz on the material [Appendix D]. They could take as much time as needed to answer all the questions which typically lasted 5—10 minutes overall. After completion of the quiz, participants were debriefed, thanked, and given time to ask any questions about the study.

Proposed Analysis

First a comparison of learning condition and score will be used to examine differences in active versus passive learning outcomes in this study. Both the mean and standard deviation in

score will be calculated and compared using an independent samples t-test. This will be done independent of student interest, to check if the expected increase in score due to active learning is present.

Next a relationship between interest and score will be established in each condition and overall. This can be done using simple linear regression to get a sense of the overall impact of student interest as well as differences in impact from learning condition.

To compare this relationship between learning conditions, a multiple regression analysis will be used to analyze. This analysis technique was chosen because there is a single dependent variable of academic performance (indicated by scores) being affected by the two independent variables of interest and technique used. The results of this test should determine if student interest actually has a statistically significant effect on active learning outcomes.

While not the focus of this experiment, pre- and post-ratings of interest could also be compared to get a sense for enjoyment of the material. Additionally, differences in time spent on the material, gender, academic year, and college major (likely Psychology vs Non-psychology) may also be examined for confounding effects.

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Appendix A

Please Rank your interest of the following subjects on a scale of 1 – 7 with 1 indicating complete disinterest and 7 being great significance.

Psychology:

Public Health:

Mindfulness:

Body Language:

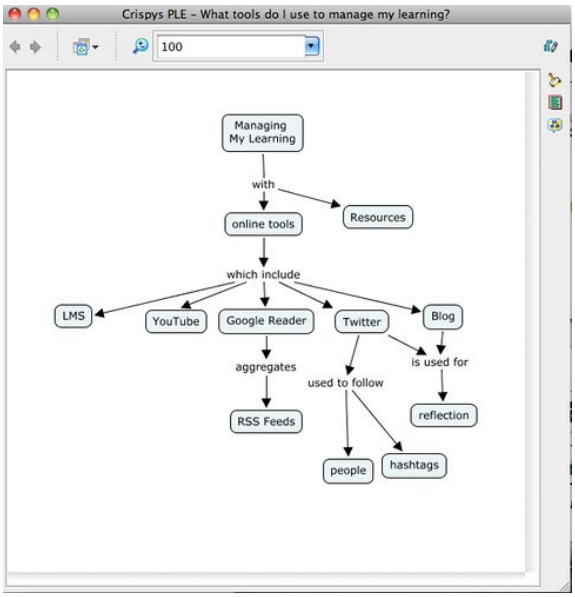
Appendix B

You will now be asked to watch a 15 minute talk about those topics. After you have completed watching the talk you will be asked a few questions about the contents and overall themes of the talk.

https://www.ted.com/talks/kelly_mcgonigal_how_to_make_stress_your_friend#t-15680

Passive: During the talk you are asked not to take notes of any form. You may pause the video at any moment and subtitles are available if needed.

Active: During the talk you will be asked to draw a concept map including any information you believe to be relevant and important. Here is an example of a concept map (show image). A concept map is a diagram that is used to show the relationships between concepts in order to organize and structure various forms of knowledge.



You may use a pen and paper or any drawing program on your computer to create this map. You may pause the video at any moment and subtitles are available if needed.

Appendix C

We will now take a short break to collect some demographic information. Again, all this information will remain confidential and not be publicly available.

What is your age?

What gender do you identify as?

What is your current school year?

What is your primary major?

How interested were you in the talk?

Appendix D

For the final part of this experiment, you will be asked to take a 10 item quiz on the video you just watched. Take as much time as you need to answer these questions and let the researcher know once you are finished.

Active: Please put away the notes you took during the talk and do not refer to them during this quiz.

1. What was Kelly McGonigal's previous view of stress
    a. Stress can be harmful depending on how you view it
    b. Stress is bad for your health
    c. Stress is good for your health
    d. Stress has no effect on your health
2. Who had the lowest risk of dying?
    a. People who experience a lot of stress and view stress as harmful
    b. People who experience a lot of stress and don't view stress as harmful
    c. People who experience a little stress and view stress as harmful
    d. People who experience a little stress and don't view stress as harmful
3. Who had the highest risk of dying?
    a. People who experience a lot of stress and view stress as harmful
    b. People who experience a lot of stress and don't view stress as harmful
    c. People who experience a little stress and view stress as harmful
    d. People who experience a little stress and don't view stress as harmful
4. In the social stress test, which of these did researchers NOT do to increase stress?
    a. Counted down time remaining
    b. Discouraging nonverbal feedback
    c. Verbal harassment
    d. Gave subjects difficult math problem
5. What differences in the physical stress response can be seen in participants told to think positively about their stress response?
    a. Perspire less
    b. Return to normal breathing
    c. **blood vessels stay open**
    d. slower heartrate
6. What stress hormone was mentioned that leads to greater social support
    a. Vasopressin
    b. Adrenaline
    c. Oxytocin
    d. Norepinephrine
7. What physical benefits can be seen from this stress hormone?

a. Decreased heartrate during stress
b. Greater social support
c. Decreased Adrenaline response
d. Strengthening of the heart

8. In the final study, the stress related increase in dying for people who experienced major stressful life events was:
a. 30% higher than normal
b. 15% higher than normal
c. The same as average
d. 30% less than normal
9. In the final study, the stress related increase in dying for people who experienced major stressful life events but spent time caring for others was
a. 30% higher than normal
b. 15% higher than normal
c. The same as average
d. 30% less than normal
10. What mechanism does Kelly McGonigal suggest is best for stress resilience.
a. Thinking Positively
b. Relaxing
c. Human Connection
d. Meditation
11.