

Student Attitudes and Approaches to Learning in a Science Classroom

Puneet Singh Gill and Stephen Douglas Benigno

MANUU College of Teacher Education, Sambhal – 244032, U.P., India.

ABSTRACT

Students' attitudes and perceptions may influence their test preparation strategies. The type of assessment may also affect the preparation protocol. The goal of this action research study was to examine the attitudes of students as they prepared to take an assessment and explore the relationship between student attitudes and their preparation for specific types of assessments. Multiple choice and essay examinations were chosen as the assessments for this study. The findings of the study indicate that students preferred multiple choice examinations. The findings also indicate that the students utilized an overall surface approach to learning in preparation for the assessments. However, students also indicated that they believed the essay examination was the more accurate of the two assessments and that grades on the assessments were more important than knowledge of the science content.

Keywords: relation, research, assess, influence.

One of the largest standardized test cheating scandals in American history ended on April 1, 2015, when 11 public school educators were convicted of racketeering in a conspiracy to inflate test scores in struggling schools (Severson & Brown, 2013). Ignored in this tragedy is the effect that high pressure tactics can have on the students and their preparation for the assessments. Attitudes and perceptions regarding the strategic importance of an assessment may have an impact on students' preparation for the test and their attitude toward the content of the course. The goals of this study are to understand

the learners' attitudes, beliefs, and motivations for learning. An understanding of these student perceptions can facilitate the development of a more authentic assessment.

Are students being "conditioned" to give one-word responses instead of critical responses? According to Struyven, Dochy, and Janssens (2005), the method in which students learn material influences how students approach learning. The experience of the evaluation process can guide future preparation for learning. Teachers are expected to authentically assess students and take into consideration multiple theories related to learning when designing instruction. Reports since *A Nation at Risk* (Department of Education, 1983) infer that many 17-year-olds do not possess the higher order intellectual skills necessary for advanced thinking. The report also indicates that nearly 40% cannot draw inferences from written material, one-fifth cannot write a persuasive essay, and only one-third can solve a math problem requiring several steps.

Access this article online	
Publisher	Website: http://www.ndpublisher.in
	DOI: 10.5958/2230-7311.2015.00015.X

Address for correspondence

MANUU College of Teacher Education, Sambhal – 244032, U.P., India.

E-mail: puneet.gill@tamiu.edu

Submission: 20 March, 2014

Accepted : 12 June, 2015

Published: 30 August, 2015

Traditional strategies utilized to extract information from students have included multiple choice, true/false, short answer, and essay assessments. Essay examinations have recently gained popularity as an alternative means of assessing higher order intellectual skills. However, Madaus and O'Dwyer (1999) stated that critics describe alternative assessments as more time consuming, vulnerable to manipulation, more costly, and less reliable. It is becoming more difficult for educators to assess student outcomes when critical research on both ends of the spectrum is contradictory. It is imperative that educators understand how students conceptualize information and how that attitude can affect student preparation and outcomes. The goal of this action research study was to examine the attitudes of students as they prepared to take an assessment. The study explored the relationship between student attitudes and their preparation for specific types of assessments.

Review of the Literature

The two most common types of assessments are multiple choice and essay tests. Educators are continually looking for more valid strategies to assess students authentically. Although there is no clear consensus about what defines an alternative assessment, most claim that the alternative assessment is the opposite of a standardized test. The performance assessment is typified by open questions, products, performance, and portfolios. These types of assessments have been utilized by educators extensively and are not new.

As Madaus and O'Dwyer (1999) explained, "The power of an examination to shape what is taught and learned was noted as far back as the 16th century" (p.689). Some of the first assessments to be administered to students in 1709 were oral tests. Horace Mann later replaced the oral assessments with written examinations. He discovered that the written assessment "allowed examiners to pose **identical** sets of questions **simultaneously**, under **similar conditions**, in **much less time** to the rapidly expanding school body thereby producing comparable scores" (p.692). Mann realized that he could gain political leverage through the written examination process because of an increase in objectivity and numeric accountability. Specific test results could be utilized to hold teachers accountable and distinguish between higher and lower ordered thinking skills, and the results could be published in the school newspapers (p.692). Later in the century, the written examination was replaced with the short answer format,

which increased accountability and was utilized to promote or retain students.

With the advent of the school-based efficiency movement and a growing population, multiple choice testing strategies became popular. "It was the multiple choice item that greatly facilitated the development of the ubiquitous national, norm-referenced, standardized, commercial tests that Americans have come to know and either love or hate" (Madaus & O'Dwyer, 1999, p.693). The advent of the optical scanner in 1955 and the utilization of computer technology in the 1970s allowed teachers to grade more efficiently and cost effectively. In the 1980s, an emphasis toward the performance type of assessment became popular but the same issues concerning accountability, efficiency, and cost effectiveness still persisted with educators, administrators, and especially policy makers (p.693). Since the advent of *A Nation at Risk*, concern has manifested itself in educators and politicians over the direction of the nation's educational reform.

According to Urban and Wagoner (2004) much of the discussion concerning the downfall of the U.S. educational system was a sensational attempt to develop an awareness in the public with respect to the academic deficiency in the United States compared to the economic rivals of our nation. The indirect assumption that the economic superiority of other countries is directly related to their educational superiority was clearly supposition. Urban and Wagoner claimed that according to critics, the economic and demographic shifts in the United States were changing the dynamics of education but the change was not indicative of a consistent pattern of educational decline. Nevertheless, many politicians, educators, and professors have been concerned with high stakes testing results.

According to Struyven et al.'s (2005) review of the literature, student perception of an evaluation task may determine their understanding of the evaluation and the assignment. Students may use different strategies on different assessments based on that perception. In this review of literature, Struyven et al. (2005) cited Trigwell and Prosser's (1991), Entwistle and Ramsden's (1983), and Entwistle et al.'s (2001) studies on three primary approaches to learning. First, the surface approach is characterized by procedural problem solving with little understanding of the content. Second, the deep approach to learning is characterized by an intention to understand, an active conceptual analysis, and a deep level of

understanding. Third, the strategic or achieving approach to learning is characterized by the student's intention to achieve the highest possible grades by using organization, study strategies, and effective utilization of time.

Multiple choice questionnaires and examinations have a strong association with surface approaches to learning (Scouller and Prosser (1994) cited Ramsden (1988), Thomas and Bain (1982, 1984), Newble and Jaeger (1983), and Watkins (1982). Yet, Hamilton (1994) suggests students' perceptions of enjoying a test or its difficulty can change depending on their experience with new formats. In their study, students felt more confident with multiple choice assessments in the math study. They suggest perhaps this is because older students are used to the high stakes testing culture.

This review of literature conducted by Struyven et al. (2005) discussed a study by Marton and Säljö (1997) on surface and deep approaches to learning. The first study attempted to solicit a deep approach to learning to solve problems, but the students reverted back to "an extreme form of surface learning" where students answered the questions but used an involuntary method of answering the questions (p.328). In their second study, the researchers asked questions designed to elicit specific responses from a group of students. The students were encouraged to use either the surface approach to learning or the deep approach. According to the researchers, the students chose the surface approach to learning out of convenience. The evidence suggested that caution must be taken when attempting to manipulate learners toward a deep approach to learning. These studies indicate that perceived assessment requirements may have a strong relationship to the type of learning that is utilized by the student. Therefore Ramsden (1997, cited by Struyven et al., 2005) indicated that testing practices can encourage the surface type of approaches to learning but different assessment types might not be enough to encourage deeper thinking with students.

Student Attitudes About Assessments

The emphasis on student accountability can help to improve student learning. According to Imrie (1995, cited by McDowell & Sambell, 1999) quality is secured by "clear and justifiable links between objectives, assessment and outcomes" (p.107). The high stakes testing movement has emphasized instructional accountability. However, the attitudes and preferences of the student in regard to assessment have not been an emphasis of

study. These researchers further stated that student preference was often ignored. The reasons given for this were lack of assessment knowledge, bias, and direct involvement with the assessment process (p.121).

Learning is a personal process through which students construct knowledge within their pre-existing knowledge. Constructing knowledge requires reflective thought where students are actively thinking about an idea (Van De Walle et. al, 2010). Thus, student learning potential can be related to what the students will allow themselves to learn. In addition, the allocation of time committed to study can have an effect on student learning, and students who are more engaged in a particular subject are more likely to study and have more favorable outcomes.

There are factors that students take into account when deciding to adopt a surface or deep approach to learning. Extrinsic and intrinsic motivation are important considerations in students who complete work. As McDowell and Sambell (1999) explained, whereas extrinsic motivation may compel students to complete required assignments, intrinsic satisfaction can encourage a deeper desire to understand the required task. Furthermore, these researchers found that students were interested in the expectations of the assessments. The students would use this information to guide their study. Further findings in this study revealed that students believe that examinations largely tested memory or poor learning, and were inappropriate ways of assessing genuine abilities and knowledge.... In cases of alternative assessment, many students did find stimulation and challenge; they considered that the tasks were meaningful and would allow genuine learning to be assessed. (p.121) Collectively, these studies revealed that student perceptions of the assessment may guide their preparation.

Methodology

The researchers conducted a qualitative and quantitative research study through an action research project within the classroom. Action research can help the researcher make a connection between theory and actual practice within the classroom. That connection may lead to improved instruction and more authentic learning. As Hubbard and Miller (1999) explained, questions that researchers ask are related to the gaps between the instruction and the learning in the classroom. Action research may also promote confidence within the teacher with respect to instruction and also encourage student

achievement (Johnson, 2005).

The study analyzed students' thoughts and attitudes through journals, a survey, field-notes, and the results of the multiple choice and essay assessments. The purpose of this study was to understand student attitudes and the approaches that they may use in preparing for multiple choice and essay type science assessments. Understanding student attitudes and student preparation strategies can facilitate the development of more authentic instructional strategies that can lead to more authentic learning.

The following questions guided this study:

1. What are student attitudes toward the use of multiple choice and essay tests?
2. What approach do students use when preparing for a multiple choice and essay test?

Participants and Setting

Participants included 25 students in the ninth and tenth grades who were enrolled in an advanced biology class during the study. The high school was located in the midst of a rapidly expanding community that drew students from diverse socioeconomic and ethnic backgrounds. The students were enrolled in block schedules with four classes each semester. Each student could receive one credit per course. The total school population was 1,112 students; 342 students in grade 9; 304 students in grade 10; 246 students in grade 11; and 220 students in grade 12. The student demographics were as follows: 55% Black, 41.5% White, 2.3% Asian, and 1% Hispanic. Within Grades 9-12, students were required to take all core content areas.

Data Sources and Method

The data collection consisted of personal observations, field notes, an attitudinal survey, and student journals. Students wrote their journal responses prior to and after the assessments. The teachers used the same teaching methodology for both the multiple choice and essay examinations. Students completed an attitudinal survey about science that attempted to measure students' attitudes toward science and their perceived ability to achieve in the science content area.

Students also completed a weekly journal entry at the beginning of every class during a 6-week period. The journal

entries were used to elicit responses about attitudes towards different types of assessments and their preparation for these assessments. The researcher also maintained an anecdotal journal. The researcher monitored student test scores in an attempt to establish a relationship between journal answers and student performance.

Verification

In order to ensure that the data would be verifiable, the researcher utilized different types of data sources in order to triangulate. In order to ensure the validity of the data, two other science teachers read student journal responses and graded the essay tests. When students were writing journal responses, the researcher ensured them that their personal journal entries were not graded and the exams were based on their knowledge of the material, not the study that was being conducted. The students understood that the study was voluntary, that their grade did not reflect the opinions in their journal entries, and that their participation in the study would have no bearing on their exam scores. All students, regardless of whether they participated or not, were given the same types of examinations to ensure that testing was consistent.

Students' names were not used in the analysis, and the principal of the school was notified of the study at both the beginning and the conclusion of the study. In addition, all students obtained permission from their parents to participate, and the researcher obtained permission from the Institutional Review Board to conduct this research.

Research Results

Student Attitude Inventory

The researcher collected the initial data by using the Science Inventory instrument. The inventory measured student perceptions related to self-confidence, enjoyment, value, and motivation in the science content area. The results of the instrument allowed the researcher to tabulate an overall student score. These data were used to compare student perceptions with scores attained by the same students on the multiple choice and essay science content knowledge assessments.

The data on the Science Inventory instrument indicated that the lowest overall combined score was student motivation to learn science and the highest overall combined score was the value

for science. In general from the results of the inventory, student scores for self-confidence, enjoyment, value, and motivation ranged from 65% to 75%. Interestingly, the students who scored lower on the overall attitude toward science scored higher on the multiple choice and essay assessments. Students who scored higher on the same instrument scored lower on the assessments.

Student Journals

Student journals are utilized to increase clarity when solving problems, bring thoughts to reality, and give an overview of existing situations. These student journals addressed questions related to student attitudes concerning multiple choice and essay assessments. The questions were analyzed to determine patterns of behavior and preference related to the preparation for the assessments. The researcher also utilized research anecdotal data collected during the study.

Category One: General School Questions.

J1 #1 Since you have been in school what type of test have you taken the most?

J3 #2 Why do you think you have been exposed to one type of test more than the other since you have been in school?

J8 #1 Which method would you use to test students' knowledge if you were a teacher? Why?

Overall, in this category, students indicated that they experienced more multiple choice examinations than any other type of assessment. Some students preferred the multiple choice test because of the choices available and the breadth of knowledge that it would cover. The students that preferred the essay test believed that the assessment required a more extensive amount of content knowledge.

Category 2: Preference Multiple Choice or Essay Format

J3 #3 Do you believe that the essay type test or the multiple choice type test is a more reliable way of measuring intelligence? Why?

J3 #1 Which type of test do you prefer? Multiple choice or essay format?

J6 #3 Do you believe that the essay test is used to test basic facts of information or is this test used to test a deep understanding of material?

J7 #4 If you frequently flew in a plane and the pilot's knowledge of how to fly the plane was determined by you, which test do you prefer him to take to demonstrate his knowledge—a multiple choice or essay test? Why?

The students expressed a concern about the difficulty of taking the examination without prior information about the content of the test. Most students did agree that the essay test commanded a greater understanding of the subject matter. The student responses were not consistent with respect to their preference of tests. Students preferred the test with which they were most familiar. The multiple choice assessment was characterized as the most commonly used assessment in their classes. The essay assessment was deemed the most appropriate for measuring intelligence according to the students.

Category 3: Preparation for tests

J1 #1 In this class do you spend more time studying for essay/short answer tests or multiple choice tests?

J2 #1 For the previous MC exams we have taken how did you prepare for the tests? (Second Essay test)

J2 #2 Approximately how much time do you devote to studying for the multiple choice exams?

J2 #4 Approximately how much time do you devote to studying for the essay exam?

The majority of the students studied longer in preparation for the essay examinations. No specific study strategy was preferred by the students.

Conclusion

The purpose of this study was to investigate the relationship between the selected assessments and student performance and attitude toward the assessments. The students believed that a wider breadth of knowledge was required when taking an essay examination. Overall, the students valued the science content but they did not indicate a strong motivation to gain knowledge of the subject. The following are the results of the study:

1. The results of the Science Inventory in the motivational category revealed that science did not appeal to the students. Students did not have an interest in pursuing science courses in the future. The results of the Inventory also indicate that the students who had the highest regard for science as a content course recorded the lowest test scores.
2. Interestingly, students with the lowest scores on the Science Inventory, in the motivational category, scored the highest on the essay examinations over the science content.
3. Student responses in the journals indicated that the multiple choice type of test was the predominant assessment strategy used in school. Students stated that they preferred the multiple choice tests because of the choices given and the breadth of knowledge that could be assessed. Essay examinations were also chosen by some students. Students did not offer an alternative to these two types of assessments. Student responses in the journals indicated that they used both surface and deep approaches to learning.
4. Student responses in the journals indicated that the essay examination was the most reliable measure of intelligence. However, when students were asked what assessment they preferred they chose the multiple choice. Students seem to utilize the surface approach to learning but understand that the essay format will solicit a deeper approach to learning.

The results of this study are consistent with the research findings. The analysis of the anecdotal data, observations, and journals indicate that students developed an overall surface approach to learning. The conclusion to the study was predictable considering the history of test reform and the context of high stakes testing in which instruction is now taking place. Student attitudes toward assessment have evolved because of the current emphasis on testing.

Impact of Test Reform on the Classroom

An increased emphasis on accountability has had an impact on instructional delivery and assessment in our classrooms. Instructional design in the classroom has changed. Creative curriculum implementation strategies have given way to test preparation modes of instruction. Student attitudes toward specifically learning science content are also being affected

by the change in emphasis in the curriculum. Students who are not stimulated beyond the requirements of the test may be devoid of a deeper understanding of the curriculum and employ a surface approach to learning. This idea is reflected in *The Structure of Scientific Revolutions* by Kuhn, where he spoke, almost prophetically, to the nature of our current scientific enterprise. Kuhn argued that the educational system is a rigorous system that plants a seed deep within the minds of students in the form of “normal science” that is based on the assumption that we know what the world is really like (Kuhn, 2012). Kuhn maintained that scientists are looking for an ultimate truth that he feels does not exist. Kuhn’s philosophy can be compared with current strategies related to test preparation in which teachers prepare the students for the test at the expense of creative and innovative instruction.

According to Einstein, “The most important thing for a teacher to impart to the children is not information and knowledge but rather a longing for information and knowledge and a respect for spiritual values be they of an artistic, scientific or moral kind” (Kinechole, Steinburg, & Tippins, 1999, p. 49). Kinechole et al. argued that schools should exist to help students direct their lives, locate themselves in history, and make them agents of democratic change. The researchers advocated for change, to intrinsically motivate students by allowing teachers to develop a double consciousness so that “teachers are aware of their thinking processes and the thinking process of their students” (Kinechole et al., 1999, p. 52). These authors also felt that the preparation for taking a standardized assessment neglects the thinking process. They believed that this type of test preparation does not encourage the development of an intuitive meta-awareness of the curriculum in the students.

Missing from the classroom is the drive and desire to learn that stems from an intrinsic need to understand and digest as much of the curriculum as possible. Unfortunately much of this intrinsic need has degenerated into an attitude that reflects the need of the student to obtain the highest grade possible with the least amount of effort. School has shifted from being an enterprise where all students are highly motivated to one in which the achievement of the highest test score receives priority.

Can relevant programs related to the student experience in science be effective in the classroom? If student attitudes toward the science curriculum are affected by the assessments,

how might a change in the entire paradigm of teaching affect student understanding of the nature of science? Can alternative assessments encourage the student to develop an intrinsic desire to utilize deep approaches to learning? The effectiveness of the educational system may depend on the system's ability to teach students to actively construct meaning for themselves in lieu of the reductionist philosophy that has recently dominated educational discourse.

References

- Hamilton, L.S. 1994, April. *An investigation of students' affective responses to alternative assessment formats*. Washington, DC: The National Science Foundation. Paper presented at the annual meeting of the National Council on Measurement in Education.
- Hubbard, R. S., and Miller, B.M. 1999. *Living the questions*. Portland, ME: Stenhouse.
- Johnson, A.P. 2005. *A short guide to action research*. Boston, MA: Allyn & Bacon.
- Kinehole, J. L., Steinburg, S. R., & Tippins, D. J. 1999. *The stigma of genius*. New York, NY: Peter Lang.
- Kuhn, T. S. 2012. *The structure of scientific revolutions*. Chicago: The University of Chicago Press.
- Madaus, G.F., and O'Dwyer, L.M. 1999. A short history of performance assessment. *Phi Delta Kappan*, 688-695.
- McDowell, L., and Sambell, K. 1999. Fitness for purpose in the assessment of learning: Students as stakeholders. *Quality in Higher Education* 5(2) 107-123.
- Scouller, K.M. and Prosser, M. 1994. Students' experiences in studying for multiple choice question examinations'. *Studies in Higher Education* 19: 267-279.
- Severson, K., and Brown, R. 2013, April 2. Divisions form in Atlanta as bail is set in cheating case. *The New York Times*. Retrieved from http://www.nytimes.com/2013/04/03/us/atlanta-cheating-scandal-jailing-educators.html?_r=0
- Struyven, K., Dochy, F., and Janssens, S. 2005. Students' perceptions about evaluation and assessment in higher education: A review. *Assessment and Education in Higher Education* 30: 325-341.
- Urban, W. J., and Wagoner, J. L. 2004. *American education: A history*. Boston, MA: McGraw-Hill.
- U. S. Department of Education. 1983. *A nation at risk: The imperative for educational reform*. Washington, DC: The National Commission on Excellence in Education.
- Van de Walle, J. A., Karp, K. S and Bay-Williams, J. M. 2010. *Elementary and Middle School Mathematics*. Boston, MA: Pearson.

Attitudes Toward Science Inventory

Directions: This inventory consists of statements about your attitude toward science. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel about each item. Circle the response that best describes your feelings. Use the following response scale to respond to each item.

PLEASE USE THESE RESPONSE CODES:

- 4 A = Strongly disagree (SD)
 3 B = Disagree (D)
 2 D = Agree (A)
 1 E = Strongly Agree (SA)

1. Advanced science is a very necessary subject.	SD	D	A	SA
2. I want to develop my advanced science knowledge.	SD	D	A	SA
3. I get a great deal of satisfaction out of studying advanced science.	SD	D	A	SA
4. Advanced science helps develops the mind and teaches a person to think.	SD	D	A	SA
5. Advanced science is important in everyday life.	SD	D	A	SA
6. Advanced science is one of the most important subjects for people to study.	SD	D	A	SA
7. High school advanced science courses would be very helpful no matter what I decide to study.	SD	D	A	SA
8. I can think of many ways I use science outside of school.	SD	D	A	SA
9. Advanced science is one of my most dreaded subjects.	SD	D	A	SA
10. My mind goes blank, and I am unable to think clearly when working in advanced science labs.	SD	D	A	SA
11. Studying advanced science makes me feel nervous.	SD	D	A	SA
12. Advanced science makes me feel uncomfortable.	SD	D	A	SA
13. I am always under a terrible strain in an advanced science class.	SD	D	A	SA

14. When I hear the words advanced science, I have a feeling of dislike.	SD	D	A	SA
15. It makes me nervous to even think about having to study advanced science.	SD	D	A	SA
16. Advanced Science does not scare me at all.	SD	D	A	SA
17. I have a lot of self-confidence when it comes to advanced science.	SD	D	A	SA
18. I am able to complete advanced science labs without much difficulty.	SD	D	A	SA
19. I expect to do fairly well in any advanced science class I take.	SD	D	A	SA
20. I am always confused in my advanced science class.	SD	D	A	SA
21. I feel a sense of insecurity when attempting advanced science.	SD	D	A	SA
22. I learn advanced science easily.	SD	D	A	SA
23. I am confident that I could take another advanced science course.	SD	D	A	SA
24. I have usually enjoyed studying advanced science in school.	SD	D	A	SA
25. Advanced science is dull and boring.	SD	D	A	SA
26. I like to learn new material in advanced science.	SD	D	A	SA
27. I would prefer to do an assignment in science than to write an essay.	SD	D	A	SA
28. I would like to avoid using advanced science in college.	SD	D	A	SA
29. I really like advanced science.	SD	D	A	SA
30. I am happier in an advanced science class than any other class.	SD	D	A	SA
31. Advanced science is a very interesting subject	SD	D	A	SA
32. I am willing to take more than the required amount of advanced science.	SD	D	A	SA
33. I plan to take as much advanced science as I can during my education.	SD	D	A	SA
34. The challenge of advanced science appeals to me.	SD	D	A	SA
35. I think studying advanced science courses is useful.	SD	D	A	SA
36. I think advanced science helps me in other subjects.	SD	D	A	SA
37. I am comfortable expressing my own ideas in labs.	SD	D	A	SA
38. I am comfortable answering questions in the advanced science class.	SD	D	A	SA
39. A strong science background could help me in my professional life.	SD	D	A	SA
40. I believe I am good at science.	SD	D	A	SA

Subscales

Self-confidence Items 9,10,11,12,13,14,15,16,17,18,19, 20, 21, 22, 40

Value Items 1, 2, 4,5,6,7,8,35, 36, 39

Enjoyment Items 3, 24, 25, 26, 27,29, 30, 31, 37, 38

Motivation Items 23, 28, 32, 33, 34