

## **Critical Thinking in the Elementary Classroom: Exploring Student Engagement in Elementary Science Classrooms through a Case-Study Approach**

**Abigail Jordan, Bailey Fern, Chelsea Morris, Rebecca Cross, and Smita Mathur**

James Madison University College of Education  
395 South High Street  
MSC 6909, Harrisonburg, VA 22807

**Corresponding Author: Abigail Jordan**

---

### **Abstract**

There are many factors that contribute to a classroom with engaged learners. In order to have student engagement in the classroom, teachers must create deep connections of content to the students' lives. Knowing each individual student will help the teacher to better engage each student in a deeper and more meaningful way. In the science classroom there is a common issue that students become disengaged because they do not feel connected to the content and the scientists that created the scientific concepts (Kidman, Yen, & Abrams, 2012). This case study approach explores engagement of male students in four elementary school classrooms, ranging from grades 2-5. The students' different backgrounds lead to various moments of engagement and disengagement, both promoted and deterred by teachers and other classroom factors. Although each child is unique in the way they learn, there were many common themes and similar findings found among the four students. The purpose of this study is to understand that student success is based on cognitive, emotional, and behavioral engagement. While these three engagement types are necessary for student success, disengagement is also a large contributing factor to engagement in the classroom. The potential impacts of this study include improvements to learning activities produced by teachers in hopes of higher levels of student engagement, a stronger understanding of the impacts of engagement on student learning, and strategies for working with specific student discourses.

---

**Keywords:** engagement, cognitive, behavioral, emotional, disengagement

### **INTRODUCTION**

Elementary classroom teachers strive to have all students focused, motivated, and engaged to learn each day. Engagement is the root of learning in the classroom. Classroom engagement can be broken down into cognitive engagement, emotional engagement, and behavioral engagement (Almarode, 2014). It is important that students are exposed to all three types of engagement each day to be able to achieve academic success. When they are not exposed to the three types of engagement, disengagement occurs and academic success can not take place. While disengagement is something that teachers will observe daily, the hope to understand when and why all four of these types of engagement occur for four average elementary education students and what educational implications engagement can lead to. For the purpose of this study, behavioral and emotional engagement have been combined because they are the most interrelated types of engagement.

### **MOTIVATION**

Building positive relationships with teachers and peers increases motivation, helps to develop positive behavior choices, and improves academic performance (Conner, 2011). Students become

motivated to be engaged when their close peers and friends are motivated and engaged. When a student is not motivated to learn or is not interested, they will be behaviorally disaffected. With support and involvement from caregivers, students' desire and motivation to do well in the classroom increases. This motivation leads to higher levels of engagement and academic success (Kim & Page, 2013). When teachers use more autonomy-supportive motivation, students are found to be more engaged in a lesson (Reeve et al., 2004). Perceived control and autonomy show individual relations to children's behavioral engagement in the classroom. When students feel like they can accomplish something and know what to do they feel good about themselves. Motivation in turn promotes positive student engagement.

### **ACHIEVEMENT**

Achievement is a primary correlation with engagement in the classroom. Research "in education and developmental psychology point to behavioral engagement in learning as a critical condition for predicting children's academic achievement" (Downer, Rimm-Kaufman, & Pianta, 2007). When a child is not behaviorally engaged then they are unable to achieve academic success.

Researchers Park, Holloway, Arendtsz, Bempechat, and Li (2012) found that when given more time and projects, students are more engaged. The children most actively engaged in the classroom are those who believe that effort is an important cause of school success and failure (Patrick, Skinner, & Connell, 1993).

### **RELATIONSHIPS**

Relationships between both the teacher-to-student and peer-to-peer have been noted as a factor that impacts students' engagement in the classroom. The teacher-to-student relationship serves as one of the most important foundations to student engagement. The relationship between the teacher and the students directly impacts the work and the enjoyment shown by students in a particular class (Buck, Cook Quigley, Prince, Lucas, 2014; Skinner & Belmont, 1993). These qualities directly relate to the development of students' engagement in the classroom and with the help of the teacher, can be captivated and help promote student achievement.

Peer relationships contribute to students' engagement. According to Cappella, Kim, Neal, and Jackson (2013) social capital theory suggests peers provide psychosocial and academic resources that enhance individual students' academic outcomes. Through this theory, Cappella et al (2013) found that "the negative association between behavioral problems and behavioral engagement is lessened in classrooms with equitable and interconnected social ties" (p.369). When students feel accepted and included by their peers they are more behaviorally engaged. As students grow out of early adolescence, more emphasis is put on grades instead of relationships with the teachers and classmates, leading to engagement looking different throughout the grade levels (Park et al., 2012).

### **DISENGAGEMENT**

Though not a positive form of engagement, disengagement is found in many classrooms and greatly impacts students. According to Skinner, Kindermann, and Furrer (2009) "Disaffected behaviors include the core behaviors of disengagement—namely, passivity, lack of initiation, lack of effort, and giving up. In addition, they include mental withdrawal and ritualistic participation, such as lack of attention and going through the motions" (p. 495). Overall from all of these studies there seems to be a correlating theme in the way to improve engagement and why there is a disconnect in multiple populations of students (Kidman et al., 2012). If the students do not feel genuine connections to the content they will disengage much faster, especially if there are any outside factors that can hinder their engagement (Kim et al., 2013). It is important to know when disengagement is occurring and the best ways to transform that into engagement whether it be

behaviorally, emotionally or cognitively or ideally all three. A teacher must become an enabler to those that are checked out to reenter engagement and become active participatory learners. "Creating a curriculum based purely on the needs and the interests of the child" will allow greater levels of engagement and academic success (Wilson, Lake, & McGinty, 2010, p. 238).

Disengagement can occur when students are not told to do something directly. The study conducted by Minogue, Madden, Bedward, Wiebe, and Carter (2010) found that students did not refer back to their science notebooks unless told to do so by a teacher. The researchers also found that the students were not making connections to earlier concepts; such as referring back to an original hypothesis. If teachers make the effort to encourage students to make connections, students are more likely to begin making connections on their own. (Minogue et al., 2010).

### **PROBLEM STATEMENT**

The purpose of this study is to understand that student success is dependent on emotional, behavioral and cognitive engagement. Along with these three critical types of engagement there is the latter form of engagement known as disengagement. The broad objective of this study is what impacts the various forms of student engagement found in elementary science classrooms? The specific objectives that were studied included: What are the contextual factors that impact the frequency of emotional/behavioral engagement? What are the contextual factors that impact the frequency of cognitive engagement? What factors lead to disengagement?

### **MATERIALS AND METHODS**

For this study, the researchers established triangular validity through using two different data collection methods for each objective. The first tool is student interviews, while the second tool is a Partial Interval Recording Form completed by the researchers. The specific objectives and methods of data collection are listed in the table below.

### **PARTICIPANTS**

The researchers have found that many students tend to associate science with elderly, Caucasian males, leading us to want to explore the actual engagement of this specific group (Kidman, et al., 2012). Therefore, all of our participants are of the male gender. The participants in our study ranged from grades 2 to 5, with one student chosen from each grade level. Participants were chosen out of the sample of consent forms that were returned from parents and or guardians. From those returned, if option was available for researchers, they chose a male student that was on grade level in reading and math. Four different grade levels were chosen for

varying results. For confidentiality all names used are pseudonyms.

### **TOOLS**

Two tools were used throughout the course of this study. The first tool was a student interview tool that allowed students to share their perceived level of engagement. This interview included a rating scale. A rating of 3 or 4 was interpreted as engagement, while a 2 or 1 was interpreted as disengagement. Free response questions were interpreted by the researcher who knew the most about the individual student, making the researcher the most qualified to determine the engagement of the student. The second tool that was used was a Partial Interval Recording Form. The contextual features that were focused on changed for each type of engagement observed. Examples for behavioral/emotional included looking for facial expressions from the student, the attention of the student, and perception of the students' interest. Examples for cognitive engagement included the student asking and answering questions in the class, helping to collect data on the student's cognitive engagement. Lastly, examples of contextual features for disengagement included fidgeting in class, playing with supplies in their desk, or taking multiple frivolous breaks to avoid classwork.

### **RESULTS**

The first three participants of this study all attend the same school. This school is a rural elementary school on the east coast of the United States consisting of grades prekindergarten through fifth grade. The total student population nears 200 students. The school is a Title One school with a little under 50% free and reduced lunch population. The final participant of this study attends an elementary school in a rural city on the east coast of the United States with grades kindergarten through fifth grade. The total student population nears 500 students.

#### **Jonathan: Small Group Work and Engagement**

The science classroom is setup where the students first receive large group instruction and then break out into either small group or individual work. The class then comes back together as a large group for debriefing on the topic and activities they completed. The class uses both a hands-on approach as well as worksheets. The student observed for this case study, Jonathan, a seven-year old Caucasian male, is a higher achieving student in a classroom of 13 students. Jonathan is reading on a high second grade reading level and is in both the high groups for reading and math. He enjoys playing baseball, going to church, and coloring different pictures.

During the observation period, the researcher observed several days of cognitive and behavioral/emotional engagement. The student is

most engaged in these areas when he is participating in a hands-on activity. The researcher observed many days where Jonathan was involved in both small group activities and large group activities. He is hesitant to answer questions in a large group setting, but when he is in a small group setting he participates by answering questions and even helps his other classmates when they are confused (cognitive and behavioral/emotional engagement). Jonathan strives for perfection and is often reluctant to answer questions about himself because he does not want to give an incorrect answer.

During this small group setting, Jonathan shows little disengagement where as in a large group setting he does not volunteer to answer questions and is often playing with his shoes or looking around the room. In addition, Jonathan is always engaged when he is given something to color or draw.

According to the Partial Interval Recording Form he believes that he is engaged when looking at the teacher, following directions, and not talking. Often times he tells the researcher that he was thinking about other things such as baseball during the science period. In addition, Jonathan has not been exposed to the science curriculum as he should be, this in return causes disengagement. Though the pacing guide instructs a rotating schedule of three weeks on and three weeks off between science and social studies, this was not seen as teachers took choice in instruction.

#### **Doug: Hands-on Activities and Engagement**

This science classroom uses a lecture and note taking setup in which students highlight printed notes and follow the teacher's lead in drawing correlating pictures to the notes. The class includes mixed media methods, including short video clips and online quizzes. The student observed for this case study, Doug, a ten-year old Caucasian male, is a lower achieving student in a classroom of 17 students. At the time of the study, Doug was reading on a 3rd grade level and was diagnosed with Attention Deficit Hyperactivity Disorder about halfway through the research period. Doug enjoys football cards, drawing, and using different writing utensils in the classroom. Doug illustrates metacognition as he shares his honest opinion about himself and his disengagement in the classroom.

For Doug, times of the most cognitive and behavioral/emotional engagement occur during a small-group, hands-on setting. During the observation period, the researcher observed a day of small group experimentation in which Doug correctly answered simple questions directed at the group (cognitive engagement) and asked to continue the experiment with other materials past the allotted time (cognitive and behavioral/emotional engagement).

While working in this small group setting, Doug was smiling, exchanging ideas with classmates, and speaking in a loud and excited voice. This social atmosphere seemed to motivate Doug to work hard and finish the assigned tasks, leading to an ideal engaged environment.

While following the teacher lead drawing in his interactive notebook, Doug oftentimes engages in questioning or answering questions. According to Doug's answers to the Partial Interval Recording Form questions, Doug's favorite part of science is drawing, leading to a perceived emotional engagement from the researcher. Though these were simple drawings, Doug oftentimes enjoyed using different pens or colored pencils during this time. The type of note taking in this science environment does not require an extensive amount of cognitive or behavioral/emotional engagement, leading to Doug having periods of disengagement.

By at least 30 minutes in to the hour-long class period, Doug will stand up at his desk or find a reason to move around the classroom (example: throw away trash, walk to teacher's desk, find other coloring utensils from backpack). His periods of disengagement occur during long periods of note taking while the students are all sitting in their desks.

#### **Alex: Movement and Real World Connections and Engagement**

The science classroom is set up with two large learning communities with seven desks at each area. There is a reading rug in the front of the room, which is often utilized for read alouds of various science trade books. A typical lesson entails a warm-up activity with correlating worksheet and an interactive activity, that sometimes occur on the rug or in their desks. Alex is an Caucasian, third grade male in a class of about 14 students. His home life varies from his peers as he is from a family of higher socioeconomic status who live in a single-family home with his parents and two siblings. Alex loves being outdoors and active, he is always telling stories of hunting with his father and playing outside with his brother. He enjoys being physical and has a hard time staying still during instruction. He is a very respectful and likeable student with many mostly male friends in the grade. He is in the higher half of reading instruction for the grade but the lower half for mathematics instruction.

Alex is a well-liked student that maintains good grades and always try's to be respectful and attentive during science lessons. It is easy to tell when he is cognitively and behaviorally engaged because he is facing the teacher, looking at those who are called upon, diligently working on the assignments and often raising his hand to contribute. About half of the time he raises his hand and gets called on he answers

incorrectly but that does not deteriorate his enthusiasm and participation in the class. He enjoys coloring and active activities.

About 15 to 20 minutes into the science lesson Alex always becomes fidgety either with an eraser or some small manipulative he can pull at and play with in his hands. He also tends to stand, rock his chair, or rearrange himself at his desk. He never does this disruptively and much of the time he does not realize he is doing it. The times this researcher has seen and noted him showing disengagement was when he was lost or confused in an activity after instruction or was on the reading rug sitting next to a friend and would talk quietly with him, always trying to do it without the teacher noticing.

#### **Conrad: Perceived Self-Autonomy and Engagement**

The science classroom set up changed various times over the case of the study; in the beginning the students sat in groups and by the end of the study, the students were set up in a row formation. The teacher uses printed notes sheets, which the class reads aloud and highlights the important factors as well as various projects to reinforce the key parts. Conrad, a white-Caucasian male, is a higher achieving student in a class of 23 students. He is on a 7th grade reading level at age 11 and is on medication for Attention Deficit Hyperactivity Disorder. He also has glasses but does not always choose to wear them; most days observed during the study, he would move to the front table even if he had his glasses with him. He enjoys reading, playing football, and talking about interesting facts about topics such as sports facts or trending news topics.

In the case of Conrad, it was hard to determine when he was cognitively engaged in a lesson, as he would often appear distracted from the content that was being presented. Throughout the course of this study, it was observed that Conrad would move from his seat for most science lessons. At the beginning, it was believed that this was to better help him focus but from observing the student further, it was found that it was due to the fact that he could not see the board. He would often take various objects to the front table with him; some of the objects included highlighters, a pencil sharpener, or a book he was reading for fun. These objects would distract Conrad from looking at the information on the board. When reading his fun book, he would often look up to make sure the teacher did not catch him doing something he should not be doing. Although he was often behaviorally disengaged, based on the Partial Interviewing Recording Form questions, he knew that he was not following the behavior expectations set out by his teacher.

On various occasions, he would raise his hand and if a classmate presented the wrong answer, he would blurt out the correct answer. There was one test observed during the study and the student scored high on the test. These two examples show that although he may not appear to be cognitively engaged during a science lesson, he comprehends the material. The moments where he was most cognitively engaged were also the moments when he was socially engaged. Throughout the study, the class did various group projects and Conrad would often take charge in his group. When asked about this, he said that he felt like he knew the content better than the other members of his group so he felt as though he should be in charge.

### DISCUSSION

One of the best methods for promoting engagement is to use a constructivist approach in the classroom. One example of a constructivist approach is the Five Es model. The Five Es are engagement, exploration, explanation, elaboration, and evaluation. Through using this model, a teacher can promote all the layers of engagement in the classroom. (Boddy, Watson, & Aubusson, 2013). In the various classrooms and students that were observed, the most engagement overall was found in small group settings that incorporated the Five Es. These were seen through exploration in hands-on approaches, student explanations of learning concepts, and elaboration of concepts through small group learning activities. Social relationships that are formed through structured small group settings not only lead to behavioral engagement, but allow for higher levels of cognitive engagement through teaching others (Cappella et al., 2013). Though best when all used together, teachers who utilize various parts of this model at different times of the day have seen higher levels of student engagement and achievement, similar to the engagement that we observed during the usage of this strategy (Boddy et al., 2013).

Through this study, movement was seen as a result of engagement, whereas some might see movement as disengagement. Perceived control and autonomy in the classroom can lead to allowed movements, which can encourage student engagement (Reeve, Jang, Cattell, Jeon, & Barch, 2004). When teachers develop a relationship with students where students feel comfortable enough to stand while doing work or move around the classroom for activities, higher levels of engagement are seen. For the students in this study, standing while working on classwork or planned movement tended to help keep the students on task, rather than serving as a distraction. In the classroom, physical stimulation lead to both cognitive and behavioral engagement.

An area that the researchers were not expecting to be a key factor in disengagement was fidgeting. While

the researchers do not believe that fidgeting is always negative, with these specific students researched, objects tended to be a major factor in disengagement. These objects included erasers, pens, books, and other objects found in the students' desks. Though these objects lead to less acting out and vocal interruptions, they lead to much higher levels of disengagement. The researchers found that these objects became a hindrance to the students during long periods of lecture.

During the interview process with these four students, varying levels of metacognition were illustrated through their responses. It was unexpected and interesting to hear three of the four students regularly respond to the interview mentioning that they were paying attention because "their eyes were on the teacher." The researchers realized that this happens because teachers oftentimes train students that their on task actions determine student engagement. These actions lead to behavioral engagement, but often do not involve cognitive engagement. When students responded that they were not engaged, they regularly responded with honest and candid answers about the distractions they were thinking about, often including sports and the outdoors.

### LIMITATIONS OF STUDY

One limitation of this study is the case study approach and the data collection of only four participants leading to a much smaller sample size. Though not seen as a limitation by the researchers, others looking at the data collected might view the use of only male participants as a narrow field when looking at student engagement. As mentioned, some classrooms had inconsistent science instruction throughout the data collection period, leading to yet another limitation of the study. Finally, the lack of the variety of instruction types by the teachers in the classrooms studied only allowed for researchers to collect data on a few varying engagement situations.

### CONCLUSION

Through our research, we have found that male students in the elementary classroom often need multiple forms of engagement to learn. Specific examples of engagement include physically stimulating opportunities and moments that involve emotional engagement such as personal connections to material. It is important for teachers to remember that behavioral engagement does not always relate to cognitive success. For students to truly understand and connect to science material, a layered engagement approach must be administered.

### REFERENCES

Almarode, J. (2014). Association of Teachers of Exceptional Children. *Engaged or not engaged...that is the question.* 27-32.

- Boddy, N., Watson, K., & Aubusson, P. (2003). A trial of the five es: A referent model for constructivist teaching and learning. *Research in Science Education*, 33(1), 27-42.
- Buck, G., Cook, K., Quigley, C., Prince, P., & Lucas, Y. (2014) Seeking to improve African American girls' attitudes toward science: A participatory action research project. *The elementary school journal*, 114 (3) 431-453.
- Cappella, E., Kim, H., Neal, J., & Jackson, D. (2013). Classroom peer relationships and behavioral engagement in elementary school: The role of social network equity. *American Journal of Community Psychology*, 52(3), 367-379.
- Conner, T. (2011). Academic engagement ratings and instructional preferences: Comparing behavioral, cognitive, and emotional engagement among three school-age student cohort. *Review of Higher Education & Self-Learning*, 4(13), 52-66.
- Downer, J. T., Rimm-Kaufman, S., & Pianta, R. C. (2007). How do classroom conditions and children's risk for school problems contribute to children's behavioral engagement in learning? *School Psychology Review*, 36(3), 413-432.
- Kidman, J., Yen, C., & Abrams, E. Indigenous Students' Experiences Of The Hidden Curriculum In Science Education: A Cross-National Study In New Zealand And Taiwan. *International Journal of Science and Mathematics Education*, 11(1), 43-64.
- Kim, H., and Page, T. (2013). Emotional Bonds with Parents, Emotion Regulation, and School-Related Behavior Problems Among Elementary School Truants. *Journal of Child and Family Studies*, 22(6), 869-878.
- Minogue, J., Madden, L., Bedward, J., Wiebe, E., & Carter, M. (2010). The cross-case analyses of elementary students' engagement in the strands of science proficiency. *Journal of Science Teacher Education*, 21(5), 559-587.
- Park, S., Holloway, S., Arendtsz, A., Bempechat, J., & Li, J. (2012). What makes student engaged in learning? A time-use study of within- and between-individual predictors of emotional engagement in low-performing high schools. *Youth Adolescence*, 41(3), 390-401.
- Patrick, B. C., Skinner, E. A., & Connell, J. P. (1993). What motivates children's behavior and emotion? Joint effects of perceived control and autonomy in the academic domain. *Journal of Personality and Social Psychology*, 65(4), 781-791.
- Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion*, 28(2), 147-169.
- Skinner, E., & Belmont, M., (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, 85(4) 571-581.
- Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioral and emotional participation in academic activities in the classroom. *Educational & Psychological Measurement*, 69(3), 493-525.
- Wilson, K., Lake, D., & McGinty, S. Re-engaging Disadvantaged Youth through Science: Developing a Framework of Practice. *The International Journal of Interdisciplinary Social Sciences*, 5(6), 237-246.