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Effects of role-goal methods on student engagement: A case study

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EFFECTS OF ROLE-GOAL METHODS ON STUDENT ENGAGEMENT: A CASE STUDY

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I. Introduction

As a pre-service teacher, areas of focus that I have found to be incredibly intriguing are student motivation and student engagement. How educators motivate their students in their respective classrooms is something that has always been of interest to me. Many topics, including science – my field of teaching – are often remembered by students as the class they disliked the most or the one with the poor teacher. This could be due to a number of factors; it may be the style of teaching, the methodology of teaching, the age of the teacher, the curriculum itself, etc. The list could go on, but it circulates around one main question: How can teachers motivate their students to learn?

This study focuses on exploring conceptual contexts and instructional methods-- mainly ones that are of *new* interest to the field and ones that are not widely used by educators of today. My research involves looking at the contextual methods that are possessed by teachers to see if they can positively impact the learning of the students, their participation, and their engagement.

One aspect that I wanted to focus in on during this study was keeping a generation with everything at their fingertips engaged. While many schools are going one-to-one with technology with laptops, tablets, or iPads, this only increases the likelihood of students are "Google-ing the answer." These Generation-Z students, or otherwise known as iGeneration (which seems to be more fitting), are our future (Jones et. al., 2007). How we engage our students has changed over time, and teaching science in the classroom looks different today with the implementation of the Next Generation Science Standards. The state of Iowa Board of Education adopted the Next Generation Science Standards with some modifications in 2015. The standards are learning expectations in science for grades K-12, and they refocus the way science is taught to help students truly grasp the subject and apply what they have learned (Iowa Department of Education, 2015). These standards move away from the traditional use of step-by-step lab activities and lectures and move to an inquiry-based learning approach.

Education is the future for the next generation. How educators choose to impact this next group of bright, young minds is up to them, but I wanted to have a say in it. This research focuses on Virginia Pitts and Daniel Edelson's "Role-Goal method," where students are in the driver's seat of their own learning (Pitts & Edelson, 2004, 2006). By using Pitts and Edelson as a guide, I worked with Dr. Ben Olsen of Helen Hansen Elementary School in Cedar Falls, IA, where we were able to use the Role-Goal method with an enrichment group of seven fifth graders, formally declared "talented and gifted" during a case study.

II. Literature Review

Engaging students in the classroom is a daunting task for any educator. In a time where the world can be explored on a hand-held device, keeping students engaged can be challenging. In addition, with the creation and modification of science standards, mainly due to the Next Generation Science Standards, the science classroom looks differently in today's schools compared to previous years and previous standards. These new standards move away from inauthentic practices, such as step-by-step laboratory experiments, and gear more toward epistemic and social practices that scientists use, like scientific modeling and argumentation. These current reforms advocate that K-12 students gain proficiency in the knowledge-generating practices of scientists.

Researchers have discovered and uncovered new methods to gain student interest, promote learning, and increase engagement in the science classroom over the past few decades. While motivation in itself is a broad topic, the factors that affect motivation can be explored. For example, research done by Jay Lemke (1990) focused on how educators talk in a science classroom. By showcasing communication, Lemke introduces themes analyzing episodes of a classroom and looks into how teachers and students "talk science" (p. 1). Lemke also touches on how language is used in talking science and how the words we say affect interests and attitudes. By simply changing the words we say, students can interpret scientific practices differently.

In his book, *Talking Science: Language, Learning, and Values* (1990), Jay Lemke writes how the classroom is not isolated from attitudes, values, and social interests of the larger community. Both students and educators bring these with them to class. Science teaches values; whether those values agree with students' values or with students' views of things, science is still a thought-provoking aspect of learning. However, some believe that science is too dogmatic, impersonal, or even inhuman. These feelings about science all contribute to what is known as the "mystique of science", where only "experts" can have 100% truth and valid opinions on subject matter (p. 129). According to Lemke, learning science is easier when science teaching builds on student prior knowledge and teaches them to use their common sense and using that knowledge to reason with new problems. Learning science becomes more difficult when science is talked about as some sort of secret knowledge that only can be understood by scientists (p. 145).

To get students engaged, science needs to be presented as a specialized way of talking about the world. Gone are the days of science only being understood by the intelligent mystery-solvers of the world. We need to present science as not the one true and only view of the world, but as one view among *many* that each need each other to make sense. This presentation can have a dramatic effect on how students take hold of new content in the science classroom. By presenting new information, the goal is to engage students, not turn them off. Motivating students to learn is a skill, and it is something that is not easily done. However, teachers can present content in a way that helps students develop an appreciation for it.

Appreciating science content.

According to Kevin Pugh (2011), students DO possess the power to develop an appreciation for school content. He argues that choosing content that affords every day applications and rediscovering the everyday affordances of core content can benefit student learning (p. 285). His research found that teachers should teach content that can be uniquely applied to the everyday lives of students and can seek out the everyday applications of big ideas. Pugh advocates that by tailoring instruction to model content appreciation, students can create a sense of the learning process, and they can grow to understand that learning is a worthwhile endeavor.

Finding beauty in learning science.

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Research done by Girod, Rau, and Schepige (2002) referred to finding beauty in scientific ideas. They propose that teaching should strive to foster learning of powerful science ideas in ways that connect to the beauty of those ideas (p. 574). Furthermore, these researchers propose that students who appreciate content tend to have a firmer grasp and stronger knowledge base of content being presented.

Girod and colleagues state that science learning is something to be "swept-up in, yielded to, and experienced" (p. 575). It joins cognition, affect, and action in productive and powerful ways (p. 575-576). A powerful scientific understanding puts someone in close, personal contact with ideas that can, and should, change the way we think, feel, and act. Teachers should strive for developmentally appropriate experiences with an appreciation for aesthetic values of science ideas. In the eyes of this research, students are not only students but artists. Science is an opportunity for these artists to find new meaning in objects, events, and ideas by creating and thinking deeply, not just by using old methods.

Teaching and learning can and, in my opinion along with other researchers cited in this paper, should be guided toward having meaningful experiences, connecting people to the world, and thinking about powerful science ideas. Teaching science can involve engaging students through the beauty, power, and value of core scientific ideas. By moving away from traditional teaching styles, teachers can use new methods, such as teaching aesthetically, to provoke young adolescent minds. These ideas can be transformative, compelling and dramatic, and unifying (Girod et al., 2002, p. 578). This idea is intriguing because it focuses on aspects of the classroom that often do not get discussed. It is not often that educators hone in on the *beauty* in what they teach and how this can affect students.

In their same 2002 paper, Girod et al. describe a ten-week study done in an urban, Midwestern, fourth grade classroom. They found that pedagogical strategies that focus on facilitating experiences and aesthetic understanding were effective by recapturing and reshaping content into the artful and compelling ideas that they are, and by drafting "what if" questions, where the imagination can explore the power of ideas. The students were asked to respond on a 5-point, Likert-type scale, with the scores 1-5 being increasing gradations of yes, where 2 was, "yes, somewhat like me" and 5 was, "yes, definitely a lot like me" (Girod et al., 2002, p. 585). The researchers were interested in the actual learning of the students as the goals of the instruction were shifted from solely pedagogical to aesthetic understanding.

As a result, the researchers found that it is important how students experience learning and value for ideas discussed in the classroom. Teachers should strive to foster learners' abilities to truly think about the world around them. This aesthetic view leads to richer, more fulfilling lives by merging in and out of school experiences.

Introducing the role-goal model.

How teachers facilitate experiences and engage their students will impact how their students learn. Whether those tactics include outside forces, sources from within, or pedagogical strategies, how teachers teach and present content will ultimately impact how students learn. As I began to research, I asked myself a question: "What are some other ways students can be engaged to promote learning?"

There is one area of research that is fairly new and, in my opinion, understudied. The "role-goal" model, researched by Pitts and Edelson (2004) allows for students to be in the driver's seat of their own learning. They are expected to take on a goal and role in the classroom. The goal involves solving a problem, and the role is a particular way of interacting with such problem. By using the role-goal model, it is assumed that the goal and role will motivate the learning of the classroom context, and that learning in pursuit of the stated will lead to better understanding. In their 2004 conceptual article, Pitts and Edelson laid out their reasoning for why a role goal method should be effective in science instruction. Role adoption and goal adoption should influence the nature of participation and engagement in activities (p. 421). Additionally, in order for role and goal adoption to be influential to student learning, the resulting outcome should somehow correlate to student success.

To exemplify their role goal method, Pitts and Edelson (2004) describe a group of students participating in a "What Will Survive" life sciences curriculum, in which students first take on the role of task force members who pursue the goal of ridding the Great Lakes of the sea lamprey, and then play the role of scientists who pursue the goal of finding out why Finches are dying on the Galapagos Islands. In this description they point to the "subjective task value", which includes intrinsic value, utility value, attainment task value, and cost. A key to making students adopt roles and goals is to have them be intrinsically motivated, or presenting them opportunities to find enjoyment or subjective interest in the context. The extent to which a task relates to current and future goals is known as the utility value, and the attainment task value aligns with the personal importance of doing well on the task. Finally, the cost deals with the negative aspects of engaging in the task, such as performance anxiety, fear of failure, and foregoing other choices in order to make this one.

Student experiences within a curriculum will affect their adoption of roles, goals, and participation and engagement. It is also important, according to Pitts and Edelson (2004), that the role and goal are consistent with each other in order for student perspectives to align well together (p. 424). Students indicated during pilot interviews of the study that they were more likely to adopt the role they were given if they felt the goal they were pursuing, the activity they were engaged in, and any additional roles they were expected to take on "fit" with their understanding of what the role entailed, rather than "conflicted".

The framework Pitt and Edelson present in their 2004 paper raised some key questions that would be later further researched in 2006. Questions raised were:

- How does the actual make-up of the factors that affect role adoption, goal adoption, and participation and engagement vary across students and situations?
- Which aspects of context are most salient in influencing students' perceptions of the expected role and goal?

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- What are the implications (regarding the factors that lead to role/goal adoption and the relationship of such adoption to participation and engagement) of differences in the *type* of role and goal adoption?
- What (additional) relationships exist between role adoption, goal adoption, and participation in the activity?

As the understanding of the answers to these questions evolved, so did their ability to design engaging learning environments that better-promote student learning.

In their empirical study done two years later (2006) regarding role and goal adoption during classroom activities, Pitts and Edelson used a framework that focused on students' understanding, attitudes and beliefs, and their perceptions of the perceived alignment of a role and goal. When students buy into the overall project scenario, the scenario contributes to student motivation to participate in the activities and serves to contextualize instruction.

Students in the study were to play role of a "special task force" member pursuing a goal of developing a plan to get rid of the sea lamprey in the Great Lakes. The students were introduced to the goal and role at the beginning of the curriculum, and they participated in a series of events that introduced them to concepts that were required to solve the sea lamprey issue.

The results from this study were interesting to say the least. Three students talked as if they were actually being asked to help with this issue. Three other students indicated that the project was a bit phony, and three others looked at this study as "just another assignment" and didn't care too much about it. At first glance, it does not seem as if anything can be taken from this study. However, about 50% of the students were at least *somewhat* interested in this role-goal model and methodology, and there are multiple ways that this could act as a hook for students.

It can be inferred from these results that students care about a subject, project, or work when they believe their work matters. More particularly, caring about a problem influenced the extent to which students approached the project as if it were real. The role-goal method is different, compelling and interesting, and it has the potential to influence student participation and engagement.

Current applications of Pitts and Edelson

In a recent 2016 study, Dr. Ronald Rinehart, who is now a professor at the University of Northern Iowa, researched critical design for successful model-based inquiry in science classrooms with Ravit Duncan, Clark Chinn, Trudy Atkins, and Jessica DiBenedetti. Rinehart and colleagues cite Pitts and Edelson (2004, 2006) in their work. One of the questions the research team asked influenced by Pitts and Edelson was, “How can we find the right balance between familiar and perplexing?” (Rinehart et al., 2016, p. 20). Pitts and Edelson found a mixture of motivations drive student interest.

III. Research Questions to be answered

This paper is an investigation on how to improve science teachers’ abilities to motivate students’ science learning via Pitts and Edelson’s role-goal model. The role-goal model appears to be an excellent, yet relatively unexplored method. I believe their initial idea of targeting how students take on roles and goals in the classroom is powerful enough that it warrants replication. Questions that I intend to answer are as follows:

- How do determined “gifted” students react to the role-goal method?
- How does the role-goal method affect student motivation and participation?
- What are the ways in which role and goal adoption influences the nature of engagement and participation?

IV. Methodology

To investigate my research questions, I conducted a case study, focusing on role-goal adoption and student engagement in a fifth grade, extended learning program (ELP). The decision to perform a case study to gather information coincides with what a case study represents. According to Robert Yin (2009), one of the most important conditions for deciding to do a case study is to ask a “How?” or “Why?” question. They can be used for exploratory, descriptive or explanatory research. Additionally, Yin states that an investigator shouldn’t have a lot of control over a study’s results, and the focus should be on contemporary events, as opposed to historical ones (Yin, 2009, p. 9).

A case study is “an empirical inquiry that investigates a contemporary phenomenon in depth and within real-life contexts” (Yin, 2009). It does not represent a sample; rather, the goal is to expand and generalize theories. One of the strengths of case studies is the ability to undertake an investigation into a phenomenon in its context; it is not necessary to replicate the phenomenon in a laboratory or experimental setting in order to better understand the phenomena. As a relatively unexplored method, this is a chance to expand what is known about the role-goal method.

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In case studies, data collected needs to be triangulated in which multiple forms of data are compared and contrasted with each other and the study can be further modeled after theoretical propositions to guide the data collection and analysis. The goal of a case study should be to expand on previous theories and provide insight on phenomena in their true, real-life context (Yin, 2009). Considering how little the role-goal method by Pitts and Edelson has been previously explored, a case study is a good fit as a means to help expand their theory.

Participants & Location

The location and group of individuals chosen to conduct the case study was with a 5th Grade ELP classroom at Heather Hansen Elementary in Cedar Falls Iowa. I was introduced to the teacher, Dr. Ben Olsen, by my advisor, Dr. Benjamin Forsyth. Dr. Olsen is a former student of Dr. Forsyth. One of Dr. Olsen's classes was a group of seven, fifth grade, ELP students who could easily be asked to participate in a short, role-goal activity, which would lend itself to a case study design.

These seven fifth grade students meet with Dr. Olsen once every three days. We decided to use a unit that was already part of Dr. Olsen's curriculum. A Paper Roller Coaster unit was set to begin in mid-March 2017. This unit would be an opportunity for students to use scientific knowledge and skills to build a paper roller coaster from a kit that was purchased through Hansen Elementary School.

Procedure

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Collaborating with Dr. Olsen, we felt that this unit would be suitable to use the role-goal method because it would allow students to be in a project-based learning environment, and would allow for role and goal adoption.

As this was a study being performed on human participants, an approved IRB was necessary. Before the case study began, consent was needed by the legal guardians of the participants. A letter was sent to all guardians of the participating fifth grade students in the enrichment environment that asked for parental permission. Two copies of the permission form were included in the letter – one for the guardian to keep, and one to be returned in a sealed envelope to Dr. Olsen. Dr. Olsen and myself collected the envelopes with the consent forms and delivered them to Dr. Forsyth in a large, manila envelope. Dr. Forsyth opened them after the study and determined which data sets could be used and which needed to be omitted. The envelopes were kept locked in Dr. Forsyth's office on the University of Northern Iowa's campus. Dr. Olsen and myself did not know who did and did not agree to allow their results to be used to reduce the chances of bias when interacting with the students about their experiences.

Assigning students to their "role" and informing them of their "goal" was done using a PowerPoint presentation. Before showing the PowerPoint, the students were told to "imagine themselves differently." See Figures 1-3.

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Figures 1-3. PowerPoint presentation that was shown to the enrichment group prior to beginning the Paper Roller Coaster Unit.

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The students were given the role of an engineer who works for the fictional amusement park design firm, Thrilla Design Associates. Students were told at the beginning of the unit that this firm was famous for designing and building "amazing, thrilling, and death-defying roller coasters for amusements parks around the world." The firm that the students "work for" were approached by the Cedar Falls Tourism Association to build a thrilling roller coaster that would be the center piece for a new amusement park that was going to be built next to the pre-existing Lost Island Waterpark in Waterloo, IA. Dr. Olsen recommended this geographic relevance to get students more excited and to feel as if their project would have a local impact. The seven students were put in two groups of two and one group of three.

To begin, the young engineers were asked to research already-existing roller coasters for ideas and inspiration in order to fulfill the end goal: Create the most thrilling roller coaster to be built next to Lost Island. In the same way real engineers imagine ideas and put them on paper as conceptual models, so each student group was given a design notebook as a placeholder for these ideas:

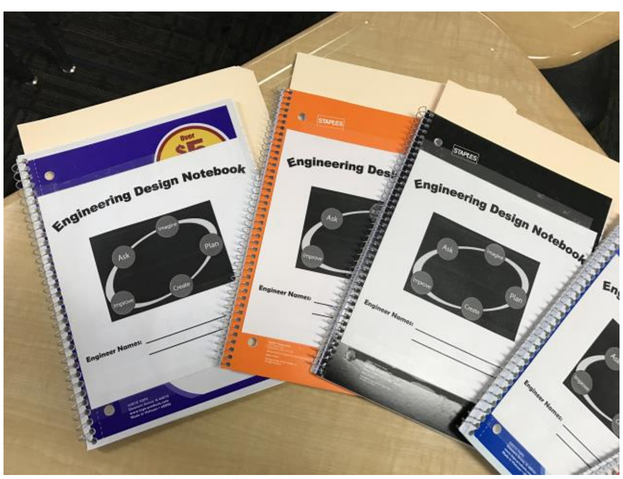

Figure 4. Photo of Engineering Design Notebooks that each group of students was given to write down ideas, draw conceptual models, and make notes necessary for building purposes.

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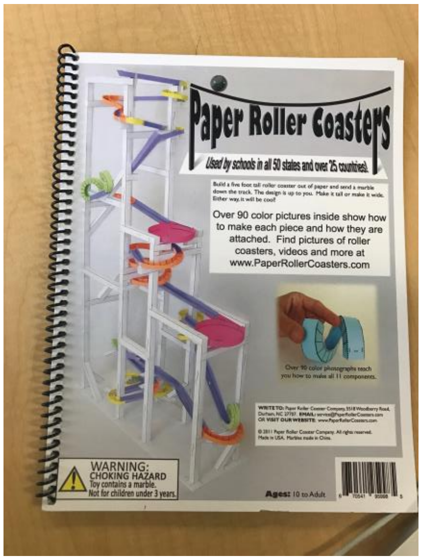
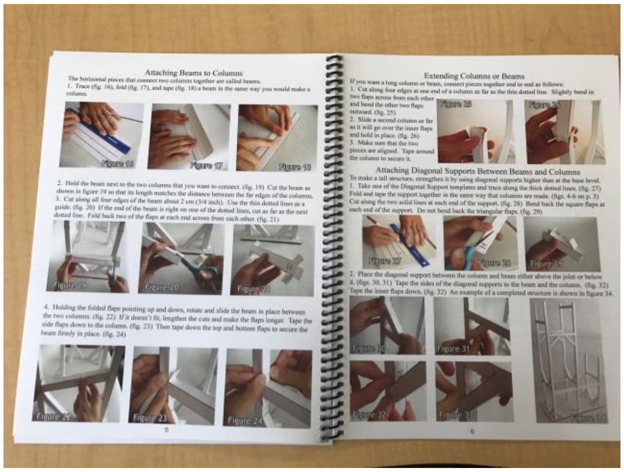
Real engineers also do virtual testing, so each group was given access to an online virtual roller coaster creator to gain knowledge on kinetic and potential energy that could be used during their designing and building process. Finally, the student engineers would put their conceptual and virtual models to action by building scale models using a Paper Roller Coaster kit. See Figures 5-10.





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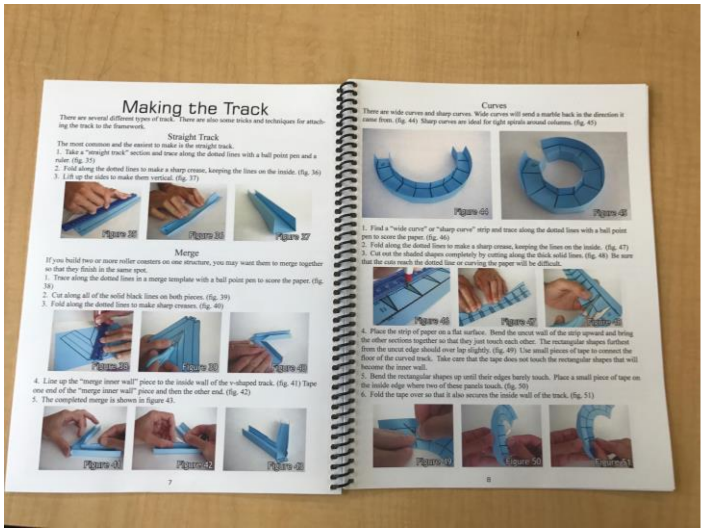
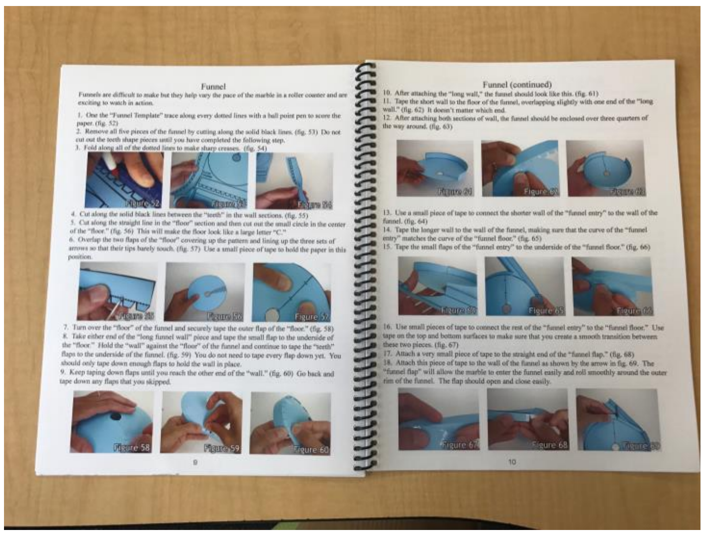
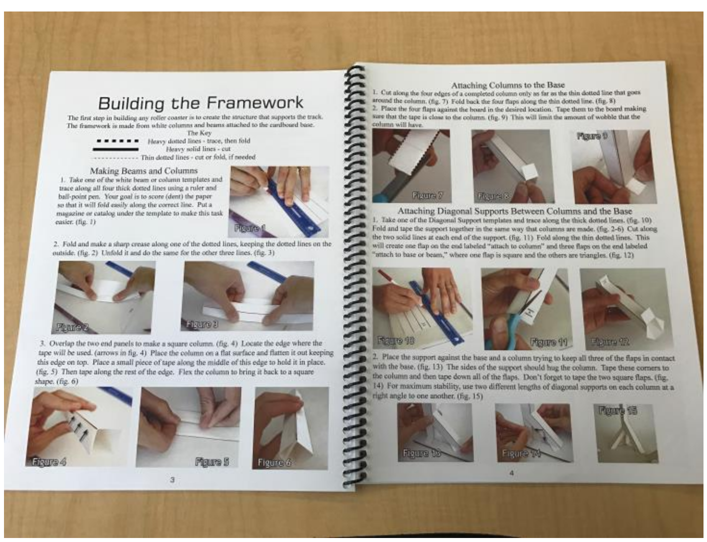

Making the Track
Straight Track
Merge
Curves


Funnel
Funnel (continued)


Building the Framework
Making Beams and Columns
Attaching Columns to the Base
Attaching Diagonal Supports Between Columns and the Base

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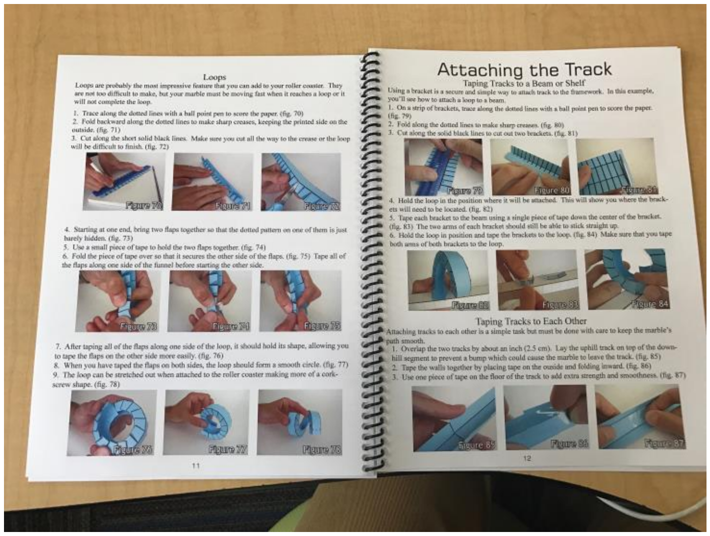

Figures 5-10. Photographs of Paper Roller Coaster handbook that students used for building their roller coaster designs.

Scale models built by the student engineers would be the primary focus of the unit. After students had conceptualized and began building their models, I conducted interviews to gain understanding of the students' general ideas of the unit in order to qualitatively analyze their attitudes, beliefs, and interests about the role-goal method. Questions used for the interviews were as follows:

- Did you like this activity? What did you like about it?
- What did this activity make you think about?
- Do you remember the topics that were talked about earlier? What were they?
- Do you remember being told what you were to be in this activity?
- How did building the paper roller coaster make you feel?

If needed, students were asked to give greater detail to their answers.

Once interviews were complete, initial thoughts and impressions were written down, and the answers to the interview questions were transcribed. When completing the interviews, I was looking for differences in answers regarding the roles and goals assigned, specifically how often or not students mentioned their assigned roles or previous topics that were discussed. In their answers, I was looking for statements involving their role as an engineer or their specific goal of creating a thrilling roller coaster. Additionally, I was interested in seeing how specifically talked about their goals and roles, much like Pitts and Edelson did in their 2006 study.

VI. Results

Initial observations

When we introduced the topic, the students were initially enthralled with the idea. Statements such as, "Can this really happen?" and "Whoa, it's just like AdventureLand!" were heard from the students. Being told that they were to take on the role of engineer, the students seemed to generate some excitement regarding their new roles. They began to research other roller coasters around the country to gather ideas and begin their conceptual model building in their design notebooks.

One group of students wrote down different aspects of roller coasters that make them thrilling, which included the following:

- Splashing water
- Steep drops and inclines
- Upside down
- Tunnels
- Speed
- Acceleration

Additionally, students would look up videos on YouTube of other paper roller coasters and real roller coasters to gather ideas and brainstorm. They began to realize that there would be no belt to pull up the "train", and gravity would have to be used in order for their marble to successfully ride their roller coaster.

As the research continued, they realized that their initial ideas may have been too ambiguous and would need extra thinking. One aspect that was missed by the groups was how the roller coasters would be supported. Cross beams and bases would be key in building their roller coasters, and slowly the students started to realize that this would have to be their starting place. Instead of Google searching, "amazing paper roller coasters," students were Google searching, "best paper roller coaster bases."

The student engineers were also quick to realize that energy was needed for these paper roller coasters to work. By working with an online roller coaster simulator, created by the JASON Digital Lab (National Geographic), allowed for students to create online roller coasters that used potential and kinetic energy. These forces would be later beneficial in the building of their own roller coasters.

When construction of the roller coaster began, the groups realized that they could not build the "cool" stuff first, which included the loops or funnels. They needed to build the structural support that could support the "cool" stuff. As one student said, "We need to build the stuff that will hold up the cool stuff."

Student interviews

Student interviews were conducted on April 20, 2017 at Helen Hansen Elementary School. Interviews were conducted during the unit instead of at the end of the unit. The unit would have taken until the end of Hansen Elementary's school year, and the time frame did not align with the University of Northern Iowa's timeline.

Five of the seven students were available for interviews; one student never returned a consent form, and another student was continuously absent. Students were asked the questions stated previously in the same order, and the interviews were conducted using a voice recorder on an iPhone 7. Once all five recordings were complete, the audio files were transcribed by the primary investigator and immediately deleted.

The answers to each question are broken down in the following tables.

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Question 1: Do you like this activity? What do you like about it?

Student	Answer
A	"Yes, I like that we have to be creative and, uh, think out problems and solutions.
B	"Yeah, it's really fun. Yeah, it's pretty fun to be working with Mr. Olson. All the technology we get to use, the fun projects, all the paper we get to use to make projects like roller coasters or pretty much anything."
C	"I do! I think it is really fun and challenging, and I think it's just away better than what we were doing before."
D	"Mmhmm. Well, I like how it's challenging and instead of being in the classroom doing boring things, we actually get to do fun things."
E	"Yeah, it's really fun. Um, well, we haven't gotten into the fun part which is making the actual roller coaster, we're working on the base, but it's fun to just like make it with your friends.

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Question 2: What does it make you think about?

Student	Answer
A	"It makes me think about, uh, what we talked about how the kinetic energy, uh, and that, and um it also makes me think about architects and being an architect and having to design a building."
B	"Um, the activity we're doing right now makes me think about like how roller coasters are planned out today to put in amusement parks, like, water parks, pretty much, yeah."
C	"I like that it's putting us into a, like, different job basically, and I can, um… like I can pretend I'm the person who's doing it. Yeah, I think it's challenging and fun, and I like working with people."
D	"Well like the roller coaster one makes me think about Lost Island because it's like a roller coaster and Lost Island has stuff except they're water slides."
E	"Physics. Like you have to be thinking ahead and be thinking about 'If I do this, what will it affect?' and you have to just…"

Question 3: Do you remember the topics that were talked about earlier? What were they?

Student	Answer
A	"Make sure that you're not going, that you don't have your marble rolling too fast because then it could crash or break your track. And not to have it go too slow 'cause then it will get stuck. Also he said we need to think about how our base is going to look because that's important when you're doing your roller coaster."
B	"Not really in particularly, I kind of, I, well, I don't know."
C	"He said to keep in mind that we want to make it fun, like pretend we are riding it make it fun, and make sure it's also safe, um, and today he said to like support beams also help so it's not wobbly."
D	"Um…. like for the roller coasters? Oh yeah you have to get a good base and not make random thing… I don't remember anything else."
E	"We have to make it thrilling. We were 'working' for this one company, and we had to make a thrilling roller coaster."

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Question 4: Do you remember being told what you were to be in this activity?

Student	Answer
A	“We were told to be architects and designers for a company that was building an amusement park, and they needed a big ride, and we were hired to build one of those.”
B	“Well, he told us to think outside the box and make sure that everything will fit together before actually taping it down like putting a base down or column down, like yeah. Anything like the beams or things like that, make sure they fit. I don’t remember what we were told to be, though.”
C	“He said to pretend we’re engineers.”
D	“The association group, we were supposed to design a roller coaster for Lost Island because they were making a roller coaster next to the water place. We were supposed to make roller coasters but I can’t think of the name.”
E	“We were told to be engineers.”

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Question 5: How did building the paper roller coaster make you feel?

Student	Answer
A	"Yeah, like in the sense that we're making all the like pillars and things, the beams in the roller coaster and so yeah, it made me feel like an architect."
B	"It's makes me feel like that I'm involved or not left out. Sometimes I might feel left out, ya know, if I don't be able to do anything, yeah."
C	"It feels a little bit like an engineer. It does make me feel like I'm actually building a real roller coaster, but in a way I'm also being myself and thinking the way I normally think."
D	"The roller coasters make me feel like, it's just cool. Mmhmm. "
E	"It kinda makes me feel like an engineer. Well, you just have to plan ahead everything. You can't do something without thinking about it before you do it because basically one wrong move and your whole thing could be over. Right now we're just working on the base and making to stable so when we get ahead, we won't have problems so it's not unstable."

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Students generally enjoyed the paper roller coaster activity. The students found things they liked about the activity; fun, challenging, and creative were all words that the students used to describe the activity and what they enjoyed most about it.

When asked what the paper roller coaster building made them think about, some students thought of scientific concepts that were discussed earlier at the beginning of the activity. Two students mentioned physics and kinetic energy while interviewed. Additionally, three students referred to thinking of themselves in a job role, such as an architect or just the ability to "pretend (to be) the person who's doing it." Three students mentioned thinking and planning ahead when building, as well as causes and effects of designing a roller coaster. These findings conform to Pitts and Edelson's role-goal method, as they were taking on a role by portraying an engineer in order to execute plans, or "plan ahead," to achieve an end goal.

Four of the five students interviewed remembered the concepts to keep in mind when designing and building a paper roller coaster, while one student did not remember the previous discussions regarding these concepts. The four students who did remember were able to recall that the roller coaster should be fun, thrilling, have a good base, and to have sturdy beams in order to support the roller coaster. One student mentioned to keep it thrilling because he was "working for this one company." The students were able to keep in mind key concepts when building, and they consistently referred back to these throughout the activity. Many conversations between students mentioned keeping a base sturdy and building strong support beams, showing that these design concepts were rooted in their building process.

METHODS

The scenarios that students put themselves in and conversations that were held between students were centered on the idea of them working to build a roller coaster. The design concepts were popular topics of conversations, and the students' abilities to think and plan ahead like real engineers were great examples of the role-goal method being played used successfully. Pitts and Edelson (2006) mention student "buy-in" in their study, and this "buy-in" is what influences their participation in the activity and their conversations.

Two students remembered that they were asked to be engineers during this activity and took on that role, while one other student said that an architect was the role that they were asked to portray. Additionally, one student said that they were a part of the "association group" to design a roller coaster. The fifth student could not remember what they were told to be.

When asked how building the roller coasters made the students feel, three students said they felt like they were in a different role, two being engineers and one being an architect. One student, who said they felt like an engineer, said that it made them feel like they were building an actual roller coaster while also still being themselves. The other student who felt like an engineer said that planning ahead was extremely important, just like an engineer. The student who felt like an architect said that building the beams and making the pillars made them feel like an architect. One student said it made them feel cool, while the last student said it made them feel involved and not left out.

Three of the five students (Students A, C, and E) discussed their roles and goals in their interviews, while the other two did not recall their initial roles as engineers. Generally speaking, these results were similar to the results found by Pitts and Edelson (2006). Not all students were able to adopt their roles and goals and use them during their two activities, and the results of my case study are comparable.

VII. Discussion

As a whole and over the course of the time spent in this classroom, the students were excited about the paper roller coaster activity. They built scientific skills as well as developed insight on what it means to be an engineer, even if some students did not recall that this was their role to portray. While they may not have realized it, these young engineers were learning to hypothesize, test, change variables, and ask questions. These traits of thinking like a scientist or engineer could be observed in my initial classroom observations as well as in their student interviews when students discussed trying to build more support beams and other structures. They realized that their initial thoughts and drawings would need some modifications when actual building of the paper roller coasters took place.

While not every student could recall their role or end goal, there is something to be said about the excitement that was generated from the activity. I believe that was attainable due to the content's challenging nature but applicable contexts. As Pugh (2011) mentions, students have the capabilities to develop an appreciation for school content. The students in this case study never once came to class with negative attitudes about what was going to be happening that day. Statements such as, "Mr. Olson, what are we doing today?", "Can we start building yet?", and "This is so much fun!" were not uncommon. Even though the students were asked to be fictional engineers, they were able to apply themselves and aspects of their roles in order to fulfill the requirements of the role-goal method. They made sense of the learning process and made it a worthwhile endeavor, thus being engaged in the activity.

This activity was something new for these students. When the activity began, most of them did not think of how a marble would run its course on the paper roller coaster track; the students wanted all sorts of twists, turns, and flips but did not take gravity and other science concepts, such as kinetic and potential energy, into effect. Mr. Olson did not use scientific jargon when explaining these concepts. By keeping the terminology simple and personal, the students were able to learn about these scientific concepts easier than using dogmatic language; they could use their common sense and knowledge to reason with the new problems that were presented. As a teacher, Mr. Olson was using Lemke's (1990) ideas of "talking science" in ways that could be understood and provide opportunities for growth from the students. By doing this, students were not isolated from the activity, and they were able to fully engage in the new information that was being presented.

This study focused in on the role-goal method and provided students an opportunity to interact with a scientific activity in a different and captivating way. Girod et al. (2002) state that powerful scientific understandings involve putting someone in close contact with the ideas that can alter the way they think, feel, and act. The role-goal method fits perfectly into this category because in order for the role-goal model to be put to use well, the user must take on a role to portray and act as that role in pursuit of an end goal. This role-goal method provided opportunities for the students to think deeply, evaluate, and create in a new way.

Two students were able to “buy in” to the activity by using the role-goal method. In their interviews, they discussed feeling like an engineer because they were building paper roller coasters, and they were able to execute their goal by portraying this role. Another student was also able to take on a role, but it wasn’t that of an engineer; it was an architect. Being an architect wasn’t necessarily the end goal of the activity, but there is something to be said about the student taking on a new role while doing the paper roller coaster activity. The student was engaged in a new way and took on a different role other than just a student, and the student felt as though they were thinking in a new way. While the specific “role” was not met, another role was bought in to, and I believe that deserves some credit.

Even though two students did not take on the role of an engineer/could not remember the role during interviews, the scenario may have influenced the way students thought about the activity, similar to that of Pitts and Edelson (2006). In the paper roller coaster activity, the students had an opportunity to apply what they talked about in preliminary discussions about what makes a roller coaster thrilling by using an online simulator. This generated initial excitement from each student, and Mr. Olson needed to pull them away from testing too much in order to keep on schedule for the remaining meeting periods and roller coaster building. Furthermore, the end goal of creating a roller coaster to be built next to Lost Island (a local waterpark that the students know of) also generated excitement from the students. The relevance of the activity, geographically speaking, was highlighted in student interviews, and it shows that when content is relevant to students, it sticks with them.

There was potential in this role-goal method and the scenarios we provided to influence student thinking, role adoption, goal adoption, and activity execution; three of the five students that were interviewed did discuss a role they were able to become and an end goal they were working towards. However, two students were unable to do so with the information and guidance we provided for them. These students may need more scaffolding than the others in order to make the same connections that the other students were able to do. The activity provided a framework for students to think differently, act as something they usually are not, and participate in a "fun" activity, and "do something cool and not boring" as one student said. I was able to identify differences between students who "bought in" and those who did not. I was also able to identify how the scenario that students are placed in can have an effect on the effectiveness of the role-goal method being used well. As a whole, the overall scenario does indeed have the ability and potential to be influential to student engagement and participation.

My research does have its limitations, however. Not all students who were in the group were able to interview: one never gave consent, and the other was absent on interview day. This reduced my results pool from seven students to five, and the data that could have been taken from those student interviews and observations could have added more information and options for analysis to my research. The research group was small for an area of study that is fairly new. A larger student pool would have been more useful.

Additionally, the students in this case study were labeled as "Talented and Gifted," and are more likely to be active in classroom activities. These students are normally highly motivated to achieve any task set in front of them by teachers. Results may look differently if an entire grade was used and not just a select group.

Finally, the research group met once every three schooldays and did not meet on a daily basis. This could have had an effect on student perceptions of the activity, and the days off in between meetings could have lessened the effectiveness of role adoption and goal adoption.

VIII. Conclusion

The purpose of this qualitative study was to explore how conceptual methods possessed by teachers could affect student engagement in classroom activities. My findings show how the role-goal method can be used to enhance student engagement by giving them a role to portray in order to execute an end goal for a given activity. While not all of the students said that they felt like engineers, each student was engaged in the activity presented to them, and some went the extra step to take on a new role in order to complete it. The role-goal method can have an effect on student engagement.

This research suggests that the role-goal method can be used in some sense to enhance student motivation and engagement in classroom activities. Based on the findings, I recommend that future analyses on the method be done in different classroom settings with more students. I also recommend that students not predetermined as talented and gifted be used for the study, as the general student population does not have this label. Time was a limiting factor in this case study and research-gathering process; I initially hoped for more time, but I was thrilled to work with the individuals I did. Even during the obstacles and constraints, I was able to impact my future pedagogical strategies and contribute to the field of educational instruction. The activities and teaching methods teachers use DO have an effect on student engagement, motivation, and learning, and this is important for every teacher to know.

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