The Role-Goal-Activity Framework Revisited: Examining Student Buy-In in a Project-Based Learning Environment

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Abstract: At ICLS 2004 we presented a framework for the study of student participation and engagement in project-based curricula. This framework was specifically designed for the analysis of project-based learning environments in that it explicitly considered the influence of student "buy-in" to an overall scenario on participation and engagement in project-based activities, and identified factors we hypothesized influenced the nature of role- and goal-adoption (including students' scenario-related understandings, attitudes, and beliefs, as well as their perception of the degree of "fit" or alignment between the role and goal and project activities). In this paper, we present the findings of a mixed-methods study we designed, based upon this framework, to examine student role- and goal- adoption in two seventh-grade science classrooms where students participated in the "What Will Survive" life sciences curriculum, and discuss ways in which we plan to revise our framework based on the study results.

Introduction

In project-based curricula, in which students develop content understanding through the pursuit of authentic problems (Blumenfeld et al., 1991), learners are expected to take on a particular goal and role. The goal involves solving a problem (such as predicting temperature on a newly discovered planet, building a playground, or developing a Global Warming recommendation). The role embodies a particular way of interacting, and is sometimes explicit (scientific researcher, urban planner, or Global Warming Advisor) and sometimes implicit (i.e., "inquirer"). An underlying design assumption behind these curricula is that the goal and role will motivate the learning of content, and that learning the content in pursuit of the goal (which serves to "contextualize" instruction) will in turn lead to better content understanding (Blumenfeld et al., 1991, Edelson, 2001, Krajcik, 2001, Rivet, 2000). However, while the goal and role are intended to play a central part in motivating activities, and are in turn one of the reasons project-based learning environments potentially lead to deeper content understanding than do more traditional, non-project-based learning environments, research to date has not explored the extent to which the project role and goal actually motivate student participation in practice. Our current line of research is intended to address that gap, through examining the extent to which students adopt or "buy into" a project role and goal in project-based curricula, and through exploring the individual and contextual influences on such role and goal adoption.

In 2003, we designed a theoretical framework to guide our investigation and analysis of participation and engagement in project-based learning environments. In the following section, we will briefly review the elements of that framework. Then, we will describe a study we designed, based upon that framework, to examine student role- and goal- adoption in two seventh-grade science classrooms where students participated in the "What Will Survive" life sciences curriculum. Finally, we will discuss the implications of these study results for our work going forward, specifically in regards to design of our theoretical framework.

Theoretical Framework

We designed our theoretical framework to represent our "working hypotheses" regarding the factors that influence student "buy-in" to an overall project scenario (that is, their adoption of a project role and goal). In considering the potential influences on such buy-in, this framework focused primarily on students' *understandings* of the role and goal, their *attitudes and beliefs* toward that role and goal, and their *perceptions of the perceived "fit" or alignment* of the role and goal with the activity in which they were engaged. In particular, we hypothesized that:

- Students develop an understanding of the overall scenario (that is, the role they are to play and the goal they are to take on) based on their previous scenario-related knowledge and beliefs *and* the way in which the role and goal are represented in artifacts, teacher talk/interaction, and peer talk/interactions.
- Based on this understanding, students form scenario-related attitudes and beliefs, including the *subjective value* of taking on the role and goal (where subjective value includes intrinsic value, utility value, attainment value, and cost) and their *expectation of success* at that role and goal. "Subjective value" and "expectation of success" come from Eccles' Expectancy-Value Model (Eccles, 1983), which describes factors that determine a student's choices in achievement-related situations.
- The extent to which students adopt or buy-into a particular role and goal is determined by these scenario-related attitudes and beliefs, in conjunction with the extent to which students perceive that the activity they are engaged in "fits" or aligns with the overall role and goal.
- When students are bought in to the overall project scenario (that is, when they have adopted the overall project role and goal), then the scenario contributes to student motivation to participate in the activities and serves to "contextualize" instruction.

Methods

Data collection for this study was completed in Spring 2004, and took place in two 7th-grade science classrooms (of about 20 students each) in a suburban middle school. Students participated in the "What Will Survive" life sciences curriculum, which consisted of two phases:

- In the first phase (which spanned approximately six weeks), students were to play the role of special task force members pursuing the goal of developing a plan to rid the Great Lakes of the sea lamprey. Students were introduced to their role and goal at the beginning of the curriculum, then participated in a series of activities introducing them to concepts required to solve the sea lamprey problem; at the end of this series of activities they were asked to draft a final solution to the sea lamprey problem.
- In the second phase (which spanned approximately three weeks), students played the role of scientists who were pursuing the goal of finding out why, on one of the Galapagos Islands, so many Finches died while others survived during a particular time period in the 1970's. Students conducted their entire investigation using the Galapagos Finches software, which gave them access to actual scientific data on the Finches populations, environmental conditions, etc. for the island they were studying.

According to our theoretical framework, the important elements to consider in examining the ways in which students come to "buy-in" to a project scenario include students' understandings of the role and goal they are being asked to take on (based in part upon the way in which the role and goal are represented "in context"), students' attitudes and beliefs toward that role and goal, and their perceptions of the perceived "fit" of the activity in which they are engaged with the overall goal and role. Therefore, we selected data collection methods that would allow us to gather data on these elements. Methods included:

- In-depth student interviews (conducted with a subset of students at the end of each phase) to gather data on students' understandings of the scenario, their scenario-related attitudes and beliefs, and their perceived "fit" of the activity with the scenario
- Daily mini-surveys (given at the end of most class periods) to gather data on the extent to which students were actively bought in to the overall scenario as they participated in activities, as well as data regarding their attitudes toward the activities
- Classroom observations to gather data on the curriculum "as implemented" (focusing in particular on the ways in which the role and goal were represented "in context").

Findings

In this section we share a subset of the results of the data analysis, focusing primarily on the first phase of the curriculum (or, as we call it throughout the rest of this paper, "the Sea Lamprey phase"). At the end of this section we briefly discuss findings from the second phase of the curriculum ("the Finches phase") as well.

Understanding of the Sea Lamprey Scenario

For the first phase of the project, students were introduced to the project scenario when teachers read them a "made up" letter from the Great Lakes Fishery Commission. When interviewed, all students understood that they were being asked to come up with a plan to rid the Great Lakes of the sea lamprey. However, surprisingly, not all students seemed to realize that the letter was "made up". Of the 12 students interviewed:

- Three students talked as if they were really being asked to help. For example, Leisha, when first asked what she thought about the letter, said, "I was really very excited to help, because we were going to start helping people to find out what was doing this to our fish and to our food."
- Three students indicated it was implausible or unbelievable that they would be asked to help. For example, Michael, when asked what he thought of the letter, said, "I thought it was kind of phony – special task force and we're just kids. How can you be on a special task force? Sounds like something the CIA should do or something."
- Three students indicated that they did not think/care about whether the letter was real or not; rather, they indicated that they thought of the project as "just an assignment" or just something they had to do for school. For example, Diana said of the project, "It's just something we have to do. I don't really care if it's real of not. It's just something that we're going to have to do for science."
- Finally, one student indicated that, though she did not think the letter was real, she chose to pretend that it was. As Kendra explained, "I pretended I was more like a scientist. It seemed like easier to take it on from that point of view."
- Two students gave no indication of their thoughts regarding whether or not the project was real (because we had not initially anticipated students would be confused as to the "reality" of the project, not all students were explicitly asked about this).

These differences in the ways students viewed the overall project are perhaps not surprising, given that neither of the teachers in the study made explicit, clear mention of the fact that this was a "made-up" letter. Certainly it seems that the apparent confusion or misunderstanding on the part of several of the students might have been avoided had the teachers simply been more explicit with the students as to the source of the letter or given the students more guidance as to what to make of it. However, there is something additional we can learn from the fact that some students indicated that they believed they were really working on a project to help real scientists solve the real sea lamprey problem, while other students saw this as just a project for school. This apparent difference in students' interpretations of, or reactions to, what it was they were being asked to participate in seems to indicate that (a) students differ in their view of what is plausible or realistic regarding their role in society and their participation in real world problems, and/or (b) students differ in the extent to which they are willing to "pretend" or "act as if" a made-up scenario is real.

In addition to the separate influences of the desire to pretend that the project is real and the perceived plausibility of the scenario, there may be an interaction between the two. A large "plausibility gap" (that is, a gap between the scenario and what students believe to be plausible or realistic) may inhibit students' ability to take on particular roles or pretend to participate in a particular scenario, whereas a small plausibility gap may make it easier for students to pretend. At the same time, a strong desire to pretend that something is real may, in essence, overcome a large "plausibility gap" such that students basically ignore the "unrealistic" aspects of a problem (paradoxically, for some students, a scenario that is especially unrealistic may for that very reason be especially desirable to take on, in that it allows students to take on a role they might never get a chance to play "in real life"). In fact, it is indeed possible that some or all of the students who talked about the project as if were real were, to some extent, ignoring the "unrealistic" aspects and, in essence, pretending the project was real due to a strong desire that it actually was real.

Scenario-Related Attitudes and Beliefs for the Sea Lamprey Phase

Five of the twelve students interviewed indicated that they cared about the project goal (of solving the sea lamprey problem), and two (of those same five students) indicated that they were excited about the opportunity to play a role different than that they normally play. None of the other seven students interviewed indicated that they found the scenario role or goal itself to be motivating, though several of them indicated that they were initially curious about aspects of the project content (such as how the sea lamprey got into the lake in the first place) or that they thought the project-activities themselves would be fun. It seems, then, that there are multiple ways in which

this particular scenario can potentially act as a motivational "hook" for students (we will discuss the extent to which such potential was actually realized later in this paper).

We did find a potential correlation between students' understanding of the scenario, expectation of success at the project scenario, and attitude towards the project scenario, such that it was the students who thought it was real or pretended it was real who thought they could do the project and who cared about the project goal or role. Given our small sample size, this is not a statistically significant finding. However, we have several possible hypotheses to explain such a potential correlation. One hypothesis is that students cared when they believed (or pretended) that their work potentially *mattered* – specifically, when they felt that their work would actually address a condition they were concerned about (seeing one's work matter requires not only that one cares about the problem itself, but requires that one believes one can succeed at doing something about it). Another possible explanation for the pattern we see here is that caring about the problem, in conjunction with expectation of success, influenced the extent to which students approached the project as if it were real. In other words, if students found the problem itself compelling, and believed they could be successful at solving it, they chose to imagine that it really was real (this would assume that even the students who said they thought it was real were, in essence, pretending as well). A similar hypothesis would be that caring about the problem influenced the extent to which students approached the project as if it were real, which in turn influenced expectation of success. We will further investigate these hypotheses in future work.

A Tale of Two Activities - Did Students Buy-In, and Did Buy-In Matter?

Regarding the extent to which students were actively "bought in" to the project scenario while participating in the Sea Lamprey activities, the two activities we discussed in-depth in the interviews were the computer activity (where students worked with a computer simulation of grass, rabbits, and foxes to better understand ecosystem relationships and the effect of adding an invasive species) and the dissecting activity (where students dissected a sea lamprey and a perch in order to learn about how different features of these species allowed them to survive). On both the computer days and the dissecting days, about half of the students said that they at least thought about the overall scenario while participating in the activity. However, with a few possible (and problematic) exceptions, there is no evidence that the students we interviewed were actively "bought in" to the project role and goal; that is, they did not see themselves as special task force members working to solve the sea lamprey problem as they engaged in these project activities (regardless of whether or not they thought the project was real, thought they could solve it, or felt positively toward the overall project scenario).

Not surprisingly, perhaps (given that students were not actively bought in to the role and goal), while students almost unanimously reported being "into" both the computer activity and the dissecting activity, none of their reasons for being into it had anything to do with the project role and goal (rather, they focused on aspects of the activity itself, such as the game-like nature of the computer activity or the fact they got to "cut things open" for the dissecting activity). However, there is evidence that, even when students did not "buy in", the scenario may still have influenced the way students thought about the activities in which they participated. For example, in the computer activity, there is evidence that the scenario may have:

- Provided an opportunity for students to make an analogy between what they were doing in the computer activity and the sea lamprey problem. For example, consider Charla, who explained, "It was just like, as the invasive species got introduced (into the grass-rabbits-foxed ecosystem on the third day of the computer activity), I was like, "Dang! The sea lamprey was an invasive species and they're endangering all the fish, and so, that's what happened with the invasive species on the computers."
- Provided students with the opportunity to apply what they learned in the computer activity to reasoning about the sea lamprey problem. For example, Raemon explained that, in the computer activity, "If you get rid of the prey, then the predators will die out. So like, if you get rid of the animals that the sea lamprey eat, so don't kill 'em, but like, move 'em to somewhere, then the sea lamprey will have nothing to eat and they will die."

While the potential is there for the scenario to influence student thinking, some students may need more scaffolding than others to make connections such as those just described. In examples such as those above, though some students perhaps made the connections between the computer activity and the overall scenario at the time of the activity, others did not make them until the interviews. There were also students who were not able to make this connection even at the time of the interview; as one student put it (in regards to the computer activity), "I really

didn't see what that had to do with the sea lamprey. I really didn't get it, 'cause it was on maintaining the foxes and the rabbits."

Looking Across Activities and Across Projects – The Scenario and Motivation

While it seems that for the computer days and the dissecting days the scenario did not play a role in motivating participation and engagement in activities, the story may be different on those days we did not discuss in the interviews (given time constraints, we could not talk about every activity in the interviews, but rather focused on a couple of activities). The days we focused on in the interviews were among the more active/hands-on of all the project activities. Quantitative analysis of the mini-survey data indicates that on days categorized as "non-active", buy-in to the role and goal may have played a bigger part in influencing engagement than on days categorized as "active". We will continue to explore this in future research, as given our small sample size, we cannot be certain that the differences in the influence of buy-in on engagement are due to the "activeness" of the days. However, potential hypotheses to explain this phenomenon include (a) On days when no other source of motivation is "dominant", the scenario may act as a source of motivation for students who are even mildly "bought in", and (b) On very "active" days, sources of motivation that are "local" to the activity (such as the hands-on nature of the task itself) may, in essence, "drown out" or overcome the motivation that comes from the scenario itself.

We also applied our framework to the examination of buy-in in the Finches phase of the curriculum. In that phase, the scenario seems to have played a much more prominent role in motivating activities than it did for the Sea Lamprey phase of the project, for in the Finches phase 7 out of 11 students interviewed indicated that cared about solving, or were interested in, the overall problem scenario, and that they were "into" project in part *because* of their interest in solving the overall problem. At the same time, however, 4 of the 11 students interviewed indicated that they were not into the project activities and did not care about solving the overall problem; rather, they indicated that all they cared about was getting a grade.

Implications of These Findings Regarding the Framework

In sum, our framework proved useful for examining student participation and engagement in this particular implementation. With the framework as our guide, we were able to identify differences in buy-in among students and across activities. We also identified ways in which buy-in to the project scenario (or lack thereof) seemingly influenced student motivation to participate in activities. For this particular curriculum, then, it seems that the overall project scenario does indeed have the potential to influence student participation and engagement.

However, while our findings indicate that the potential exists for the scenario to influence student participation, engagement, and learning, this potential was not fully realized for all students or in all activities. The question now becomes that of "why?" While we cannot answer that question definitively with this particular study, the framework does offer explanations for these differences in buy-in that are consistent with the evidence. In particular, we found instances where it seems that:

- **Understanding of the scenario** influenced scenario-related attitudes and beliefs; these understandings included the plausibility of the scenario (Sea Lamprey phase) and the extent to which the problem had already been solved (Finches phase).
- **Scenario-related attitudes and beliefs** influenced buy-in. This was especially true for the Finches phase, where students who were especially curious about what happened or who wanted to prove to themselves that they could solve the problem were the ones who indicated that they were really working toward coming up with a solution, rather than just doing what they needed to do for the grade.
- **Perceived "fit" or alignment of activity** with the overall scenario influenced buy-in (we see this with the computer activity during the Sea Lamprey phase, where some students did not understand how the activity fit in with the overall scenario).

At the same time, evidence indicates that there are other influences on scenario buy-in that are *not* adequately represented in the original version of our theoretical framework; these include:

- **"Emergent" role and goal** - There is some evidence that role was at times emergent rather than consciously adopted. In particular, during both the dissecting activity (in the Sea Lamprey phase of the project) and the Finches phase of the project, some students indicated that they felt like scientists, even though they were never explicitly asked to play that role. This indicates that students came to see

themselves in a particular way *as a result of* their participation (the original framework focused more on how seeing oneself in a particular way *influences* participation). It is plausible that students can come to take on a goal in the same way.

- **Competing goals/roles** – When students do not buy in to a project scenario, it may not always be the case that they do not understand the goal/role, or that they have no desire to take on the goal/role, or that they cannot see what they are doing as "fitting in" with what the goal and role entail. Rather, it may be that other goals/roles were simply more "salient" or "dominant". This may have been the case with students who indicated that they only cared about the grade when they were working on the Finches project, and may also have been the case with some of the students who, during the Sea Lamprey phase of the project, seemed more focused on the immediate goals of the computer and dissecting activities than they did on the overall scenario. For future work, this raises the question of why certain goals and roles might be more "salient" than others for particular students in particular contexts.
- **Influence of nature of participation** on scenario-related understandings, attitudes, and beliefs - While the original framework *did* indicate that one's scenario-related understandings, attitudes and beliefs are influenced by participation in project activities, this relationship was not emphasized, nor were the dynamics of this relationship made explicit. This relationship may require more emphasis in future research on buy-in, for there were several instances where ongoing participation in activity influenced students' scenario-related understandings and attitudes (and, in turn, the extent to which they were "bought in"). This was particularly true during the Finches phase, where some students indicated that the more they learned through participating, the more interested they became, or that the closer they got to figuring out the answer, the more they wanted to find the answer, or that the more they "put into it" over time, the more they cared about seeing their effort "pay off".

We will revise our theoretical framework based on the results of this study, and believe that this framework, as we continue to refine it, will prove useful in guiding future research that will allow us to "design for buy-in".

References

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. Educational Psychologist, 26(3&4), 369 – 398.

Eccles, Jacquelynne S. (1983). Expectancies, values, and academic behavior. In Janet T. Spence (Ed.), Achievement and achievement motives (75-146). San Francisco, CA: W.H. Freeman and Company.

Edelson, D. C. (2001). Learning-For-Use: A framework for the design of technology-supported inquiry activities. Journal of Research in Science Teaching, 38(3), 355-385.

Krajcik, J. (2001). Learning science content in a project-based environment. In Tinker, R., & Krajcik, J.S. (Eds.), Portable technologies: Science learning in context. Netherlands: Kluwer Publishers.

Rivet, A. Singer, J., Schneider, R., Krajick, J., Marx, R. (2000) The evolution of water: Designing and developing effective curricula. Paper presented at the annual conference of the National Association for Research in Science Teaching, New Orleans, USA