Stories as Prototypes for Interdisciplinary Learning

Vanessa Svihla, University of New Mexico, vsvihla@unm.edu
Richard Reeve, Queen's University, reever@queensu.ca

Abstract: Although recent research has emphasized the importance of understanding science practices and how people teach and learn them, much of this is set within mono-disciplinary classrooms, providing limited vision for how people might learn from one another in the context of an interdisciplinary lab. We present data from participant observation collected over a three-year period in an interdisciplinary scientific research laboratory as a lens into how people can learn science from one another. We depict how the participants used stories as a means to prototype their ideas over time, and how their approach to treating these stories as tentative and contingent supported them to make progress and learn together.

Major issues addressed and significance of the work

Stories are appealing because they provide narrative coherence that supports comprehension and recall (Thorndyke, 1977). They are an important part of social learning (Brown, Collins, & Duguid, 1989). Here, we explore how stories serve as prototypes to support interdisciplinary learning. If we consider the normal state of affairs in how students engage in building explanations of their understanding—particularly in traditional school science, but even in many scaffolded learning technologies, their purpose is relatively straightforward; it involves rendering data into the canonical solution. Students are seldom presented with ill-structured problems (Jonassen, 1997), and thus, are confined to basic deductive reasoning in much of their learning. Yet, even a straightforward, well-structured problem can be treated as ill-structured if it is given contingent, tentative status. Treating well-structured problems as ill-structured may actually reflect learners' experience of such problems, provided they are engaging in sense-making as they are framing the problem.

Theoretical background

Bereiter and Scardamalia (2012) argue that deep understanding "is achieved through creating and improving explanatory theories" (p. 160). They further suggest that an explanatory theory about an aspect of nature, that is a scientific theory related to a natural phenomenon, is best built from data observed across multiple cases. However, where we find existing fields of research, as well as entirely new fields of research dealing with previously unexamined new cases, we find researchers striving to make sense of the data through theory building. Bereiter and Scardamalia (2012) have referred to this as being a "theory of the case" (p. 162) and have further suggested this is the type of theorizing that is common in social studies, literature and history. However, the idea that "a good theory of a case should be able to coherently explain all of the facts of a particular case" (p. 162) is in line with data we have from scientific settings where new areas of study are being undertaken, but for which overriding theories do not yet exist. More precisely, we have found that in these research settings the efforts to pursue explanatory coherence often takes the form of creating a "story about the data."

The key to *authentic* theorizing is that it involves "continued striving toward higher degrees of explanatory coherence" (Thagard, 2000). We consider this a form of prototyping in which each prototype is tested against the contextual and contingent knowns and forms, and in/for/of a given moment. Such prototypes are tentative and liminal. In design, prototypes serve important functions; they aid designers "to either explore a design space or narrow down options and make decisions" (Hess, 2012). Sometimes, simpler prototypes lead to better design (Yang, 2005). Prototypes serve myriad purposes, with some functioning as a simplified final design and others standing in as form alone (Ulrich & Eppinger, 1995). Prototypes serve to aid designers in learning about their design ideas, communicating their design ideas, and integrating their design ideas with other existing ideas (Ulrich & Eppinger, 1995).

We argue interdisciplinary settings can serve as important learning environments, especially for prototyping explanatory stories. Interdisciplinary learning settings may be particularly beneficial to struggling students, and may invite broader participation (Committee on Facilitating Interdisciplinary Research, National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2004; MacMath, Roberts, Wallace, & Chi, 2010). Interdisciplinary work tends to be collaborative, with each member bringing different expertise, and even fundamentally different understandings of the problem (Weingart, Todorova, & Cronin, 2008); each member, also, therefore, brings a *lack* of expertise in some aspects of the problem. This creates an environment where it can be safe to *not* know something. We see this as a particularly strong setting for treating prototypes and explanations as tentative and contingent, and for this to lead to learning.

Methodological approach

We present a case that highlights how interdisciplinary research presented opportunities for students to be positioned as having some relevant expertise, and how finding a story in the data served as a means for them to prototype their ideas and ultimately learn and make progress on their work.

Setting and participants

The geomicrobiology lab is lead by Denise (pseudonym) who was a part of the formation of her subfield. Members of the lab study the role of microbes in caves. Denise's lab is diverse and includes undergraduate and graduate students (N=14 across three years, with approximately seven students participating at any one time). During the three-year data collection period, the lab typically included one or two Native American students, one African-American student, four to six Latino/a students, and a majority of students who were first generation college attendees. The gender balance was generally close to even. Denise recruits students who are "in the middle" academically, and who might be in danger of leaving or not considering science careers.

Data sources

Data were collected at weekly hour-long lab meetings across three years. The first year was documented through field notes, resulting in 64 pages of typed notes. The second and third years included field notes and audio recording, resulting in 145 pages of typed field notes and 28 hours of audio. These were supplemented with ethnographic interviews with participants. The credibility of findings was enhanced through commonly-used strategies (Creswell & Miller, 2000; Golafshani, 2003; LeCompte & Goetz, 1982). Triangulation and external audits were conducted in the first author's research lab. Member checking occurred by presenting findings at lab meetings, informal interviews with lab members and sharing paper drafts. As part of member checking, informal interviews were recorded, and participants followed up by sending presentations and journal articles annotated to explain their progress on finding the story in the data.

Analysis

Field notes were reviewed repeatedly for regularities in lab practices. Where needed, audio records of the lab meetings were transcribed to provide a more detailed record of the interactions. We present vignettes highlighting how stories served as prototypes and how this practice fostered participation. Segments shared reflect the larger data corpus. Audio records of selected data were transcribed. Transcripts were reviewed by the study team for moments that seemed most relevant to the study. These were more carefully transcribed to document pauses and tone of voice, to better convey the conversations. The resulting transcripts were analyzed using interaction analysis (Jordan & Henderson, 1995). In particular, we attended to how participants discussed story, and how they made sense of each other's contributions.

Findings

We present a narrative depicting the evolution of one instance of finding the story in the data. This story begins, in terms of data documenting it, in Fall 2012. We noticed that Denise, the PI, would explicitly lead the lab in pursuit of "the story in the data."

Denise: We have a problem. We need to find the story in Kacy's data. Tell them what your questions are.

Kacy: If bacteria in pools have the ability to precipitate, if it's not strictly a geologic process.

Denise: Crystals don't form pendant structures. But do they form these particular structures?

Elena: Do they touch the water?

Denise: They form UNDER water.

Because this geomicribiology lab is interdisciplinary, there is a commitment to developing shared understanding about data and problems, which in turn supports collective work to reach shared understanding of the data. About a month later, Denise informed the lab they'd be doing more "finding the story in the data." She explained, "I want us to develop as a lab group—finding the story in the data. A colleague sent me this manuscript, and I got lost in the data. I'd like to do several lab meetings on this." Indeed, they did engage in this practice over the entire Fall semester lab meetings. At the end of the semester, Denise asked the students to reflect on the semester, to help them plan out the Spring lab goals.

Denise: What have you found most valuable about lab meetings?

Jeff: Analyzing data and having people comment.

Denise: So, finding the story in the data?

Jeff: I was grouchy, but I got a lot out of it.

Despite Jeff's "grouchy" stance when the lab collectively sought the story in his data, he acknowledged its value; with two lab meetings devoted to scrutinizing his data, he initially reacted defensively, feeling as if he ought to have already known and tried everything they suggested. By the second session, he realized it was not intended to showcase his lack of progress, but rather to support him to *make* progress and to support everyone to learn. This practice—finding the story in the data—has persisted in the lab ever since.

About two years into data collection, Denise had gotten data back from analysis and she was trying to put a talk together. She brought the data—as a presentation with many charts and graphs—to the lab. As she shared the data, she explained what she had noticed. We have annotated the transcripts to help the reader navigate technical terms.

Denise: There are a few real oddball samples. […] I have bacteria "unassigned." That is just—they could not even get it down to a phylum, right?

Aaron: Yeah. They know it's a bacterial sequence, but nothing else.

Denise: So, the fact that this one has THAT much, that's a fair amount of possibly new orders, new phyla maybe even, right? Ok, so, that's one part of the story. So, what you're looking for as we go through this, is I want some help coming up with the story, because it's kinda slim pickings. Ok, so, what I have observed so far is there are some, there are some unusual and interesting candidate phyla *(newly identified bacteria)* […]

Aaron: What I might do here is get rid of all the sample names and then do like a, like an FMD *(ferromanganese deposit- an iron and manganese-rich, colorful deposit found on cave walls. The lab studies these to understand the role of microbes in caves)* and bracket it, so like, all your FMDs are here. You could say 'FMDs' and then do it by sample type.

Denise: Ok, I can do that.

Aaron: 'cause that'll show at least a story of "it's chaotic even within a sample type." […] You might actually be able to see some trends by sample type.

Denise: Ok. I did that in the report that I did with a smaller subset. […] I can actually organize by color within the FMD *(because FMDs come in different colors)*. I can do that and this—THIS is really interesting and really puzzling.

In this interaction, Aaron suggested a means to group some of the samples together. When Aaron suggested bracketing all the FMDs, he was suggesting grouping data together by a common attribute. Looking at groups that share a common attribute together can sometimes help us find patterns that are masked if the pattern is not shared by the whole group. Aaron noted this as he commented, "You might actually be able to see some trends by sample type." As Denise agreed this was a good approach, she noted how "really interesting and really puzzling" the data were. As the conversation continued, Denise began to envision how to group her data together.

Denise: So, just make this a list?

Aaron: Yeah, and say "Hey, we got some cool stuff. Come check this out." Right, that's actually, that's actually super. I didn't, uh, realize that about the data set.

Denise: No, in fact once it's been through QIIME *(software the lab uses to match the DNA they have to known sequences; thus, here they are puzzling over how few matches were found down to the genus level.)* the whole thing, the whole character of the data set changed. […]

Tania: Or maybe what you could do is make this really small, like put it in the corner and then just have the main points that you want.

Dr. S: What if you just showed the percent of them that are at class, the percent at family, the percent…*(trailing off)*

Denise: Is there a way to do that? Convert those to percents?

Aaron: Well, you could just add up, so how many, how many do we have total? It's like 20% or something like that, right? Then, what, how many are at the genus level? Like 40?

Tania: Yeah. That wouldn't be hard.

Denise: Oh, not how many individual sequences are in //

Jeff: //Oh no.

Aaron: Yeah, 'cause Dr. S is right. That'll convey the information better. You're saying only, out of all of our samples there's 20% at the genus level.

August: Yeah, you could do like a pie chart, right?

We note that, in this part of the transcript, there was much overlap between finding and telling the story. As soon as Denise began prototyping her story, she began to consider how to communicate it through charts and figures. As a participant observer, Dr. S was able to contribute; she failed to come up with another taxonomic rank, but her idea still made sense to the group. As the conversation continued, Denise mentioned finding bacteria in the cave that were unexpected, because they are normally found only on land. As they discussed this, they came up with plausible ways for such bacteria to enter a cave (e.g., brought in by a packrat). Tania noted this with some sense of relief in her voice at finding a plausible story in the data.

Tania: That can be explained!

Denise: Maybe. (.) But this is still, it takes us off in a totally different direction. So, I'm thinking of getting rid of that. So that's what we have. I have copies of all the graphs. I wondered if we wanted to divide up into two teams, and have people look at that. Or have you seen enough here, that you can think about what else could I make as a story. (.) So any thoughts about what would be the best way to proceed?

Aaron: I'd kinda like to see that in color by age.

Denise: We can't do that in the next five minutes. So what could we do now to help move the story along? ((laughter))

Tania: Wait, what was your question?

Denise: What could we do to help move the story along, because//

Tania: //Oh ((laughs))

Denise: Would it be worth—I have two sets of charts.

Tania: Let's do it guys.

Although the explanation for the unexpected bacteria in the cave provided a potential story, it was dismissed as "taking off in a totally different direction." It was a bit of a small story, because it could be so easily explained. Thus, they left the relative certainty of that story, and returned to puzzling over the data. We note a sense of playfulness and going boldly into the data. This was no simple task—making sense of myriad graphs and charts. They divided into two groups and spent several minutes orienting to the task, trying to make sense of what they were seeing. As they began to try to make sense of the data, Tania voiced her confusion.

Tania: This one says distance, distance, distance. But then the dots look different. I don't know what that means.

Aaron: That's a whole lot of nothing. YEP. They all say nothing.

Tania: mmhmm. ((laughs))

Aaron: Yep. Still says nothing.

James: The story is there's no story.

Aaron: No! There is a story.

Tania: That is the story.

James: THAT is the story? ((Laughing))

Tania: Now we know what?

Aaron: Each sample was kind of it's own little niche […]

Tania: We're supposed to look at these, and, um, find a story?

Denise: What other story can we come up with?

Tania: You can play dot the dots.

Aaron: I kinda like the story. It's chaotic.

Tania: I do. I—I like it.

Again, we note a playful quality to their search for story in the data; we see this as opening a space for members to play both with their talk and with ideas. The data representations were a bit unfamiliar to the students, and no clear patterns were visible. Yet the story began to take shape. They began to prototype a story of randomness, handing it around from person to person to consider. We also point out *how* the students in this lab work with Denise. This lab seems to be a safe space for students to speak up, to admit uncertainty. We attribute some of this to the interdisciplinary nature of the lab. In such spaces, everyone experiences being more novice at times, and everyone has a point of view that is valuable. Our purpose is not to delve too deeply into how this was fostered, but to call it out as a tremendous resource that can be leveraged when setting about to find the story in the data. As they continued, Aaron defended the chaotic story that seemed to be emerging.

Aaron: I mean, you can make the argument, depending on, like, how the rest of it comes out, it's like a stochastic process *(random process)* is driving this thing.

Denise: In other words, it's completely random what's on these walls?

Aaron: Yeah.

Denise: Because, I can tell them, you know the temp and humidity are really, pretty

Tania: So, are you trying to figure out why?

Denise: I'm trying to figure out what controls this diversity *(of the bacteria, which are highly diverse)*.

What we see here is that Denise, prior to fully endorsing this story, evaluated it against what she knows. Thus, with this prototype figuratively in hand, she could evaluate its fit and coherence. In contrast to how she responded to the previous story of the bacteria that was potentially brought into the cave by a packrat, this story seems to have been more compelling. While the story they were creating may be one of randomness, their search for story was far from random; rather, it was both exploratory and explanatory. They moved between analysis and inference, representing data and relationships between variables, looking for meaningful patterns, then holding these found patterns—or in this case, found randomness—against what they knew and what they expected to find. In this case, the story of randomness is unsatisfying because of this, and warranted going back to analysis, in search of other patterns, other stories.

The story, as prototyped, at a particular moment in time

We shared our initial analysis of how the lab prototyped stories, and Denise feared "that makes us look like occasionally we're just sort of bumbling idiots. […] We need to have a happy ending to this bumbling around." She thus shared with us how the story had developed as she prepared her presentation, and also how it had been further revised. When she presented this story at her conference, Denise showed how many of their samples could be identified at each taxonomic level (Figure 1). In her conclusions to that presentation, she reported on the value of using "next generation sequencing to show extensive, novel diversity […] even in physically close sites in the cave." Based on the groups' continued work on the data—a back-and-forth process of analysis and story-creation, they further made discoveries about how cave bacteria metabolize methane. She also presented several *stories in the making*—prototypes of stories tied to data that they were still trying to make sense of.

Reflecting on this story a year later, Denise explained numerous ways their story had changed.

Denise: We are a lot further along on that data because we now know, for instance, like, the black and the brown FMDs are where we find more of the new candidate phyla *(newly identified bacteria)*. […] So we know the candidate phyla are there. We also know the FMDs group together not necessarily by color. We know that depth is not important in [that cave] anyway, an:::d we know that:: um, there are processes—the metabolic processes, especially in the brown and black FMDs are, um, methanotrophic—so eating of methane compounds. They are nitrogen cycling and maybe a little bit of sulfur and iron cycling, right? […] Color is important in that red crusts are very different.

Tania: Yeah.

Denise: But you—if you go back, they're also very//

Tania: //'cause red doesn't always mean there's iron there.

Denise: No, and also//

Dr. S: //That's interesting 'cause actually later in this transcript you talk about the reason the red would be different is 'cause there's iron.

Denise: Well, we found out with Tania—so—totally different system—[another] cave—she did an analysis—a bulk chemistry analysis and there's no iron in the [red] samples. […] You can't make an assumption, is what it told us—that red means iron is present.

Thus, we see that the story was prototyped for a particular time—a conference presentation—and then further revised and reconfigured. As they have prototyped their ideas, their stories have cross-pollinated one another. Tania's explanation about the color red not meaning that iron is present—an insight from another study—informed Denise's understanding of these data. This highlights the tentative nature of scientific research, showing how each story is just a prototype—one that fits the data as currently understood, using the techniques available. We see this practice as eminently transferrable to other learning settings, provided participants treat their stories as prototypes—improvable and contingent. To further understand how the lab conducts this type of work, we consider their reflections on the process.

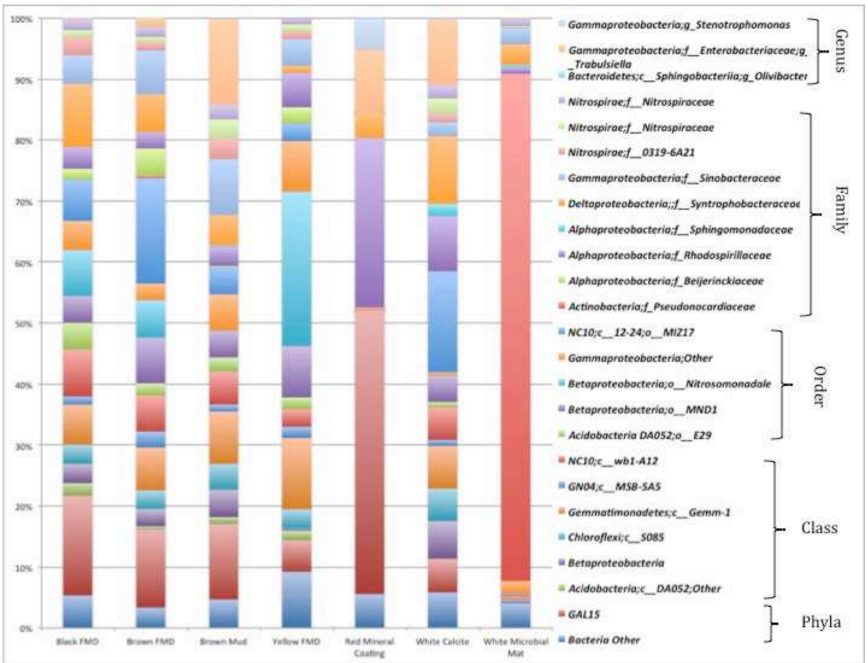

Figure 1. Image from Denise's presentation, showing how she took up ideas from the lab discussion about how to group her data.

Reflections on finding the story

Denise described a process we documented as occurring abundantly in the lab that supported their story prototyping. Participants often brought forward representations of data, and sometimes worked hard—spending 30 to 60 minutes—to help the other members understand the representation. Many times, this understanding resulted in such significant critiques that the approach was immediately scrapped or the tentative insight dismissed. Denise described an increasing level of tolerance by two of her students for having to analyze and reanalyze data.

Denise: The other thing I'm noticing is in terms of the work that Aaron and James are doing—is the first blush of analysis is—you might as well just throw it away. Um, and then, especially when I get an email that says, "Oh, it's screwed, so I just, you know I ((laughter)) […] So, I learn to just throw away that email and just wait a few days, and wait for the next email.

Treating such hard work as discardable and tentative is central to making progress as the group learns together. Similar to the "generative reasoning" described by Cross (2011, pp. 146-147) the lab members worked at the problems, rendering them more complex. Tania reflected on how valuable their process of sharing data with one another is, and how she approaches the practice.

Tania: And I think what also helps with, like, a group looking at data, is that they really don't understand—it's actually, I think, better. Because they see other things that if a person who's been staring at this—you know eight hours a day—it gives 'em new perspective. And what I notice I tend to do is, I tend to be like opposite. I try to think opposite of what we should be thinking or like or the way it seems to be going and like, I—I just do that. I don't know why.

Denise: That's a very helpful thing to do

Tania's insight that she takes an oppositional stance does not mean that she simply disagrees with everything. In fact, we saw in the earlier transcript that she came to agree with the story of chaos presented by Aaron. But the perspective shift she suggests is certainly one we observed her—and other lab members making. Such shifts further support the contingent nature of their prototyping; more importantly, such shifts make it safe for students to tentatively posit and/or try on ideas that may be only partially formed, or that may seem unlikely. We see this practice as supporting this lab's innovative work.

Denise: One of the things I find really helpful is we have those discussions, and then Aaron goes off and generates a bunch of new graphs or James does and when we look at those new graphs it's like tuning the focus in and out on a camera. Things come into focus more//

Evan: //that weren't there before//

Tania: //or a microscope//

Evan: //that weren't there before//

Denise: //or a microscope // just out of focus

Denise: Or he'll go off and do a—a graph in a totally different way and sometimes we find out, well, the ecological theory doesn't support that. We need to do it in a different way. And the thing that's most interesting, is the story VANISHES sometimes.

Ultimately, their process does lead to new insights and helps them contribute new understanding in their field, but it is a process with twists and turns, sometimes leading them to pursue prototypes that do not work. In such cases, they abandon them *reluctantly* yet clearly as they move on to other explanations for the data. Such abandonment shares little with how they discarded the story of the bacteria that had been brought in by a packrat, which was easily cast aside because it was not interesting. In contrast, stories that vanish are sometimes mourned; their passing leaves a void, waiting to be filled by new stories.

Conclusions and implications

In the vignettes above, we presented how one interdisciplinary research lab prototyped explanatory stories. We showed how this practice was brought in and cultivated by the PI as a new lab practice, and that lab members sometimes needed to experience it more than one time to see its value. We found that the stories were treated as shared and improvable, providing opportunities for learning. The problems the lab members wrestled with were ill-structured (Jonassen, 1997), and the stories they sought reflected their sense making as they were framing the problem. Part of their sense making involved evaluating the explanatory power (Thagard, 2000) of their stories, much like Bereiter and Scardamalia's (2012) "theory of the case" (p. 162), in which all of the particulars of a case can be coherently explained.

We particularly call out the tentative treatment of the stories, as it was this characteristic that led us to label them as prototypes used for generative reconstruction of the problem (Cross, 2011). Just as in design problem framing, the prototypes we observed helped lab members "explore a design space or narrow down options and make decisions" (Hess, 2012); they aided them in learning about their ideas, and integrating their ideas with other existing ideas (Ulrich & Eppinger, 1995). By positioning this process of "finding the story in the data" as one of prototyping, we have emphasized the contingent and tentative nature of their progress towards meaning making. This sometimes "bumbling" process is not so different from how learners experience problems new to them, even well-structured ones. Accepting it as not only relevant to—but also central to research process could aid us in designing learning environments that are not brittle to failure and revision, but rather endorse it. We see too much of learning in school settings caught up in seeking certainty, in answering well understood problems with efficiency and accuracy; in contrast, we consider how resilient these members were when discarding a certain, yet uninteresting story, and fording back into the dragons-be-there territory of their data to generate more complex problems on which to work. Allowing students to prototype their ideas iteratively not only supports learning, it also matches practice. Treating such prototypes as contingent and tentative, using the discourse pattern of "finding the story in the data" and engaging from an interdisciplinary stance makes it safe to try on new ideas—and thus, to learn.

Our data were collected in one specific interdisciplinary lab. In seeking promising places to look at laboratory learning, we visited many labs that self-identified as interdisciplinary; we found only a few of these labs included such equitable student participation. Our purpose in this paper was not to identify the specific supports needed to create such participation, which may be requisite to engaging in the type of story prototyping we observed. However, we argue that cultivating this story-finding practice as a form of prototyping—and therefore as a tentative process—could itself help create a culture of risk-taking in learning, where it is safe to *not* know something, to push for more complex problems and ultimately, therefore, to seek deeper levels of understanding.

References

Bereiter, C., & Scardamalia, M. (2012). Theory building and the pursuit of understanding. *Enhancing the quality of learning: Dispositions, instruction, and learning processes*, 160.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32.

Committee on Facilitating Interdisciplinary Research, National Academy of Sciences, National Academy of Engineering, & Institute of Medicine. (2004). *Facilitating interdisciplinary research* (9780309094351). Retrieved from http://www.nap.edu/openbook.php?record_id=11153

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124-130. doi:10.1207/s15430421tip3903_2

Cross, N. (2011). *Design thinking: Understanding how designers think and work*: Berg.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-607. doi:http://nsuworks.nova.edu/tqr/vol8/iss4/6

Hess, T. (2012). *Investigation of prototype roles in conceptual design using case study and protocol study methods.* (MS), Clemson University.

Jonassen, D. H. (1997). Instructional design models for well-structured and iii-structured problem-solving learning outcomes. *Educational Technology Research and Development, 45*(1), 65-94.

Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundations and practice. *Journal of the Learning Sciences, 4*(1), 39-103.

LeCompte, M. D., & Goetz, J. P. (1982). Problems of reliability and validity in ethnographic research. *Review of Educational Research, 52*(1), 31-60. doi:10.3102/00346543052001031

MacMath, S., Roberts, J., Wallace, J., & Chi, X. (2010). Research section: Curriculum integration and at-risk students: A canadian case study examining student learning and motivation. *British Journal of Special Education, 37*(2), 87-94. doi:10.1111/j.1467-8578.2009.00454.x

Thagard, P. (2000). Coherence in thought andaction: Cambridge: MIT Press.

Thorndyke, P. W. (1977). Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology, 9*(1), 77-110.

Ulrich, K., & Eppinger, S. (1995). Product design and developmentmcgraw-hill inc. *Columbus, USA*.

Weingart, L. R., Todorova, G., & Cronin, M. A. (2008). Representational gaps, team integration and team creativity: The mediating roles of conflict and coordination. *Tepper School of Business*, 528. doi:10.5465/AMBPP.2008.33662047

Yang, M. C. (2005). A study of prototypes, design activity, and design outcome. *Design Studies, 26*(6), 649-669. Retrieved from http://www.sciencedirect.com/science/article/B6V2K-4H2G928-1/2/b193b6bc47f3f8eb92ff7dd52a8fa45c