Virtual worlds, conceptual understanding, and me: designing for consequential engagement

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Abstract

Purpose – This paper aims to advance the idea of consequential engagement, positioning it as a necessary complement to the more common practices of supporting procedural or conceptual engagement. More than a theoretical argument, this notion is grounded in examples from the authors’ work in enlisting game-based methodologies and technologies for supporting such engagement.

Design/methodology/approach – Through the presentation of two example designs, an elementary statistics curriculum and an undergraduate educational psychology course, the paper attends to the potential of narratively-rich, multi-user virtual environments for positioning students to critically engage academic content. In particular, it discusses the importance of designing spaces that afford opportunities to understand and apply disciplinary concepts in making sense of, and potentially transforming, conceptually-revealing scenarios.

Findings – The paper discusses the role of consequential engagement in supporting meaningful procedural and conceptual engagement, and the potential of these designed spaces for positioning learners to develop an appreciation both of the power of the conceptual tools they engage, and of themselves and their peers as people who use these tools.

Originality/value – This paper proposes a framework for design that can be applied to both real and virtual learning environments.

Keywords Internet, Learning, Education, User studies, Information retrieval, Students

Paper type Conceptual paper

The past 20 years have brought forth significant technological innovations that have changed the world as we know it. Continuous access to online information has supported a complete change in the relationship between individuals and knowledge; with information, facts, and answers so readily accessible, people have been repositioned to move beyond the mere acquisition of facts, to consider when to access those facts, interrogate them, respond to them, and integrate them into daily activity. In addition, this ubiquitous access means that there is less privileging of who is able to contribute to these sources of information, simultaneously opening up the space of authorship to include people and ideas that were not privileged in previous forms of knowledge representation (i.e., books), and creating a need for the critical interrogation of the sources and agendas that shape the nature of information being shared. These innovations afford a very different way of participating and being successful in the world. In today’s society, it is the opportunistic enlistment and meaningful application, not procedural replication, which is valued, desired, and required for full participation. Children need to be prepared to meet these new demands of society.

As such, an important goal for education is that students both understand the formal concepts being taught and develop an appreciation for those situations in which what is being taught has value. Specifically, students need to have opportunities to engage with information in such a way that they become critical consumers and producers of information. In our work, we have sought to understand the requirements for engaging information in this
way by characterizing different aspects of students’ interaction with content. Specifically, we seek to support students’ engagement with content at three levels: procedural, conceptual, and consequential. Procedural engagement, drawing on Pickering’s (1995) notion of disciplinary agency, involves using procedures accurately (see Rittle-Johnson et al., 2001), but not necessarily with a deeper understanding of why one is performing such procedures. For example, students engage procedurally when they are able to state Piaget’s stages of conceptual development and correctly identify the typical “markers” of the different stages, or when they correctly fill in the blanks on a mathematical worksheet. As has been documented in the TIMSS study, this is a commonly observed practice in American classrooms (United States Department of Education: National Center for Education Statistics, 2003), with students practicing accurate use of procedures, often without knowing when to use the procedures, or why one might procedure might be more useful than other.

In contrast, conceptual engagement involves more than “plugging in” a number into an equation, but additionally involves an understanding of why the equation works the way it does. Conceptual engagement captures the work of sense making. It is this level of engagement that is the goal of many reform programs, which seek to support students to, for example, “learn with understanding” (National Council of Teachers of Mathematics, 2000). Continuing the example, engaging conceptually with Piaget’s theory could involve using the theory to make sense of other theories, for example, by connecting Piaget’s explanation of perspective-taking with Kohlberg’s stages of moral development. In mathematics class, conceptual engagement can be seen when students interrogate why a particular algorithm is useful for solving a particular problem, and why that algorithm leads to an adequate solution. One criticism of standardized tests is that they often demonstrated procedural knowledge, but say little about conceptual understanding.

Finally, consequential engagement requires interrogating the usefulness and impact of the selection of particular tools on outcomes; for example, students who contrast Piaget and Vygotsky as a means of supporting their decision to enact a particular practice, such as heterogeneous grouping. Likewise, a student who is engaging critically with mathematics might explain how their choice of statistical method enabled the support of a particular recommendation (and not others). This final level of engagement includes a bi-directional interplay between intentionally choosing tools based on the situation being engaged, and reflecting on the consequence of that choice in terms of the impact on situations. For learners who are still beginning to understand how particular tools work and why, this interplay is crucial both in that it can push back on students’ understanding of the tool, and also illustrate that such conceptual tools can be consequential in the world.

Consequential engagement is the most lacking from both the extant practices and many reform discussions. Beyond simply contextualizing content by situating it within a rich situation (Cognition and Technology Group at Vanderbilt, 1990), engaging consequentially involves using tools in order to have an impact on situations. This can be quite difficult to accomplish in the context of schools where students rarely have opportunity to experience the use-value of the formal content they are learning in the classroom. However, we are not simply advocating for a vocational education, but one that has aspects of procedural, conceptual, and consequential engagement. We argue that consequential engagement is a central aspect of deepening conceptual understanding, because when one uses disciplinary knowledge to examine the world, they gain richer insight into and from the world, while simultaneously pushing back on theories about the world. As such, these different ways of engaging are not separable, but interact and build upon each other. Conceptual engagement cannot occur without a robust understanding of procedures; likewise, consequential engagement can create new opportunities to engage conceptually with content. Our purpose in attending to these three levels of engagement is to better understand how to position students to become active problem solvers. A core challenge underlying our work is how to engage students in situations that allow them to use conceptual understandings as tools for gaining insight into and solving meaningful problems.
Much of the motivation for such work stems from research which indicates that the way content is engaged is a crucial component of what people come to understand about that content (Boaler, 1999; Greeno and MMAP, 1998; Lave, 1997; Saxe, 1991). For example, an educational psychologist learning about cognitive development in order to make a decision about the usefulness of tracking is very different from an undergraduate student who learns this theory to prepare for a test. This difference results in a very different conception of the use value of developmental theory as well as a different conceptual understanding of what the theory is about. For us, new information can create a lens for a way of seeing the world (Foucault, 1977), attuning people to affordances (Gibson, 1979) that might have been previously unrealized (Greeno and Gresalfi, 2008). As students have opportunities to engage with information that is relevant to the problem at hand, they are able to recognize new possibilities for experimentation and potential solution paths that were previously unrecognized. In this way, students’ new understandings serve to better attune them to affordances in the problem. Thus, in order to support students to engage consequentially, it is imperative that students have opportunities to engage content within contexts-of-use.

A fundamental question underlying our work is how to design consequentially engaging and conceptually-illuminating contexts in formal learning situations such as schools. In other words, if our theoretical argument is that learning environments need to foster procedural, conceptual, and consequential engagement, the next challenge is how to make this happen in the context of schools – a context that has significant constraints. As one option, we have worked to support consequential engagement with content through the use of game-design methodologies in an online environment that leverages a narratively-rich, multi-user virtual methodologies (MUVE). In this paper, we attend to the affordances of the MUVE for positioning students to critically engage with content such that students are afforded opportunities to understand, apply, and leverage information in the service of broader contextually-relevant critiques. In what follows, we discuss design principles for supporting the development of consequential engagement and describe two designed contexts: Normal Village, designed to support elementary students’ understandings of statistics, and Cheshire Academy, designed to support undergraduate students’ understandings of educational psychology concepts. We chose these designs because they present an interesting contrast, the former example leveraging consequential engagement to help foster one’s conceptual understanding of a procedural skill, while the latter example is about instantiating the theoretical claims in terms of their procedural implications.

Designing for engaged participation

Our goal of designing for engaged participation grows out of our experience in supporting students to engage meaningfully with content. It is important to emphasize that we are not concerned primarily with students’ abilities to replicate procedures, or accurately define terms, although these are indeed important skills. Instead we focus on students’ active engagement with content, which involves making and evaluating decisions to support the development of particular arguments or solutions. Contexts that afford engaged participation reposition the learner as change agent who uses conceptual understanding to actualize a critical agenda. As such, engaged participation has the potential to position conceptual understandings and whole persons so that they change and are changed through their interaction with situations of use (Barab, Zuiker, Warren, Hickey, Ingram-Goble, Kwon, Kouper and Herring, in press). The challenge is to design contexts that support this form of engagement. In our work, as presented above, we make distinctions between different aspects of engagement that must come together to achieve engaged participation: procedural, conceptual, and consequential. Next, we turn to the medium of videogames as an example of a designed space to support engaged participation.

In the perfect world, students would have opportunities to become immersed in authentic contexts that consistently support their understanding of novel theories and formalisms, and provide opportunities to use these theories as conceptual tools for solving problems. However, educators often cannot access rich, real-world situations with underlying narratives that centrally embody meaningful content. Even with sufficient field trip funds, it is difficult to find sites where the natural dynamics unfold in pedagogically useful ways,
especially given the abbreviated time frames of classroom learning. However, new forms of media can support the design of spaces that can position students to use tools to understand and change virtual worlds.

Over the last decade, video games have become one of the most significant forms of media for the enculturation of youth, especially males. In most contemporary videogames, learners do not mindlessly click on buttons but instead engage rich narrative storylines and employ complex discursive practices and problem solving strategies as they come to master and appreciate the underlying game dynamics (Gee, 2003). Over the last five years we have witnessed a dramatic rise in terms of the popularity of videogames both with respect to their commercial success and in terms of their educational potential (Barab and Dede, 2007; Gee, 2003). At one level, videogames are just simply fun. They challenge the player to step into new roles and explore rich virtual worlds (Gee, 2003), they offer increasingly difficult challenges that successfully balance difficulty and skill level (Salen and Zimmerman, 2004), they support collaborative problem solving and foster group allegiances (Steinkuehler, 2006), and they push us think deeply about significant ethical and political issues (Squire, 2006). Although some may still view game play as trivial and insignificant, the games of today are quite complex. Games invite players to inhabit roles and assume identities as they adopt conceptually-relevant intentions in a virtual world in which they make choices, develop skills, and experience the impact of their actions as part of a legitimate game role, allowing students to move beyond their classroom identity and become legitimate participants in the game narrative (Barab, Sadler, Heiselt, Hickey and Zuiker, 2007).

Similar to school, games provide challenges, but in this case, these challenges support problem-based goals – a possibility often absent at school. Whether we view games as problematic or beneficial, we cannot ignore the compelling methodologies and complex dilemmas and practices that these spaces use to engage children and adults for hours on end. Whereas traditional learning environments frequently describe the how and what, and then leave it to the learner to reflect on the ways in which content relates to personal situations (the why), a well-designed game provides a rich narrative that establishes the why, while the how and the what are developed through playing the game, as opposed to description about the world. Gee (2008) argues that schools provide the manual but not the game, and that any gamer will tell you that reading a manual without playing the game is confusing and unproductive. However, while one is playing the game, the manual can provide an important sense of direction and serves to deepen emergent claims.

While games have proven quite successful, we are still in our infancy in terms of how we leverage this powerful medium to bring about academic and pro-social ends (Barab, Zuiker, Warren, Hickey, Ingram-Goble, Kwon, Kouper and Herring, in press). Although the field has become more sophisticated in terms of how to make interesting educational games, offering theoretical frameworks (Squire, 2006; Steinkuehler, 2006), design principles (Barab, Dodge and Ingram-Goble, in press; Squire and Jan, 2007), and rich examples that demonstrate the value of leveraging game methodologies to bring about academic ends (Barab et al., 2005; Rosenbaum et al., 2007), we are still working to establish design principles, to consider how games change in the contexts of classrooms, and to conceptualize what assessment looks like in these new and complex spaces. The important point, in terms of this essay, is that in playing a well-designed game one has a sense of consequentiality. As one becomes increasingly proficient in the core game dynamics, her sense of consequentiality also grows in the game. In fact, it is the seamless integration of procedural, conceptual, and consequential engagement afforded through game play that has made game design methodologies and technologies such an attractive curricular platform in our work.

Instantiating the theory

In the sections below, we discuss design principles for supporting the development of consequential engagement in two very different curricular units: elementary level statistics, and undergraduate-level cognitive development. In examining two vastly different content areas, we seek to explore the affordances of various disciplines for supporting engaged participation. More generally, disciplines have inherently different practices and standards
for similar forms of engagement. For example, although many disciplines require that claims and theories be supported by justification and evidence, what counts as evidence in the various disciplines is often vastly different. Likewise, the relationship between theory and practice differs across disciplines. In the examples we consider, doing statistics involves engaging with practices such as calculating measures of center, comparing distributions, or generating representations. These practices, however, have theoretical underpinnings that support both the appropriate use of, and subsequent reasoning with, these practices. Engaging fully with statistics requires being able to use these practices in ways that are consistent with their theoretical underpinnings.

In contrast, learning about cognitive development involves engaging theories that have been developed to explain observed phenomena. Thus, knowing about cognitive development involves becoming familiar with different explanations that have been offered to account for the ways that children develop. However, these theories have practical implications, in that they are used to both explain what is happening for children and to support the design of learning environments. Engaging fully with theories of cognitive development requires using theories to support practical decision-making. As we design units, we seek to leverage students’ consequential engagement with content in order to nuance the relationship between theory and practice, and between conceptual and procedural understanding. In this way, consequential engagement serves as a bridge that connects both the tools of the trade with their meaning and rationale, whether one is focused on bringing more conceptual understanding to procedural skills or bringing procedural understanding to theoretical conceptions.

These two examples are situated within the broader Quest Atlantis (QA) metagame context and technology. QA is a learning and teaching project which leverages a multi-user engine and a narrative scripting engine so that participants can enter virtual worlds in which they encounter non-player characters, engage missions, and submit work as quests (see Figure 1). The QA virtual environment, storyline, associated structures, and policies constitute what we refer to as a meta-game context, a genre of play in which there is an overarching structure that lends form, meaning, and cohesion to a collection of nested activities, each with its own identifiable rules and challenges. The Quest Atlantis Project (http://QuestAtlantis.org) is a highly researched curriculum that has been under development for the last four years (Barab, Zuiker, Warren, Hickey, Ingram-Goble, Kwon,
Kouper and Herring, in press; Sadler et al., in press; Barab, Dodge and Ingram-Goble, in press; Dodge et al., in press; Barab, Dodge, Thomas, Jackson and Tuzun, 2007; Barab, Sadler, Heiselt, Hickey and Zuiker, 2007; Barab and Jackson, 2006; Barab, Thomas, Dodge, Carteaux and Tuzun, 2005; Barab, Arici and Jackson, 2005). It is a leading exemplar of a new game-based curriculum, with research studies revealing significant learning gains on standards-oriented assessments, including ones that are independent of the QA curriculum. Equally important have been transformative personal experiences, with teachers and students reporting increased levels of engagement and interest in pursuing the curricular issues outside of school.

Normal village

The purpose of the unit in Normal Village is to support students to begin to see statistics as tools that can be used to understand situations and phenomena (as opposed to a set of rules that they need to become skilled at executing). When students first begin the unit, they read an e-mail from the Mayor whose position of mayor is being challenged. In particular, another in-game character, who is clinging to traditional views, has argued that the mayor is making reckless decisions simply focused on town innovation in violation of what the data suggest. As an outsider, the player is recruited to investigate a series of problematic decisions that are supposedly in violation of the data. Importantly, both student and the mathematics content are positioned through this narrative as having legitimate roles; the student as an emerging expert statistician is the consultant and the mathematical content is a tool for determining the accuracy of the claims lobbed against the mayor. As students navigate the 3D space, they encounter various stakeholders who request help in making different consequential decisions about the city, including whether more traditional or innovative bikes should be available for park rental; whether increasing surveillance or police activity will be most effective at reducing crime; whether visitors to the neighborhood park should be allowed to listen to music on their headphones; and whether a baseball diamond or basketball court will be more effective in enticing park visitors. As students help to design the park by making arguments for or against particular decisions, they engage with more advanced statistical content and are challenged to offer increasingly sophisticated explanations and justifications for their decisions.

The unit was designed to afford three levels of engagement: procedural engagement was afforded by creating opportunities for students to use statistically-based reasoning accurately, for example, by calculating measures of center correctly. Conceptual engagement was afforded by creating opportunities for students to explain why their recommendations were sound and believable, both through explicit instructions in activities, and by evoking an external evaluator (the city council) who needs to understand why different recommendations are made in order to make a final decision. Finally, consequential engagement was afforded by creating activities that had more than one possible recommendation, so that students could compare the implications of their method of analysis on the way the situation was ultimately represented, and the resulting conclusions that they drew.

In the first activity, called a Quest, students are asked to offer a recommendation about which bicycle brand is safest, based on data from experimental trials regarding their braking distance. They begin by interviewing the teams who are collecting data about bicycle safety, to learn about how the data are being collected, and what “stopping distance” really means. After talking to all relevant stakeholders, students are asked to make a recommendation. In this activity, procedural engagement is supported by creating opportunities for students to make different kinds of graphs which could be used to represent the given data. Specifically, students are given a table of data from trials of two different brands of bikes, and asked to use the table to create a representation of the data. Students are able to reflect on how well their chosen representation illustrated the data by comparing across multiple representations (created by their classmates) of the same dataset. Conceptual engagement is supported by asking students to explain how they drew on their representation of the data to create a recommendation. Finally, consequential engagement is supported by designing the data so that the two distributions could
support two equally compelling arguments, based on whether students considered the average stopping distance or the distribution of the data for each brand of bike. Although one bicycle has a shorter average stopping distance (seen by calculating the mean, median, or mode of the two distributions), the other has a more consistent stopping distance (seen by calculating the range of the two distributions). Students are then able to reason whether it is more important to have a bike that usually stops faster, or one that is more predictable. In this way, they are able to examine how the use of different tools was linked to different ways of seeing the data, and thus the world it represented.

In the second quest, students learn more about what it means to be a professional statistician. After overhearing a recommendation that the questers make about reducing crime in the city, the statistics trainer decides that questers need to learn more about the power they have to make important and consequential decisions that will have significant impact on the city. Students enter a secret society of statisticians who are attempting to use their skills for change, “one number at a time.” Students learn about what it means to be a statistician by hearing how preexisting ideas, or biases, can shape one’s interpretation of data. They also learn how different statistical tools can be used to both reveal and hide important aspects of data, thus potentially introducing a second level of bias. Armed with this new understanding of the heavy responsibility that a statistician has to think carefully about their own role in understanding and interpreting data, students re-emerge to face the world that has been created in response to their recommendation about reducing crime. The world as they experience it will either be filled with surveillance cameras which are tracking their every move (an innovative decision), or a world that has many more police officers watching and stopping citizens on the street (a traditional decision).

From there, students are asked to continue to think carefully about the relationship between innovative decisions and more traditional ones by making a recommendation about whether people should be allowed to listen to music in the park. Students again have opportunities to talk to characters that have a stake in the final decision, and learn about how data were collected in order to examine the impact of music bans in other parks. They also get personal experience about how tools can opportunistically be used to support particular decisions by talking to two stakeholders who attempt to sway their decision by demonstrating how their tool (either the mode or the median) “proves” which decision is the best. Through this activity, and the follow-up licensing exam that students take, statistical procedures are presented as tools that can reveal and hide information about data. In addition, by requiring the licensing exam in order to advance to a higher level as statistician, such tools are positioned as resources for offering more sophisticated and more compelling arguments.

Students are then asked to make a recommendation to the city council about an appropriate law around listening to music in the park and to support this recommendation with data. In this activity, procedural engagement is supported by providing representations of data in order to begin to associate data points on a graph with the values they represent (instead of creating their own representations). For example, students are asked to identify benchmarks on the graph, such as minimums and maximums, so that they can begin to understand the components of the “tool” and how it works. Conceptual engagement is supported again by asking students to explain how their reading of the graph (which could be arranged in multiple ways) supported their recommendation. Finally, consequential engagement was once again supported by creating data sets that afford more than one justification for making different recommendations.

This final quest involves working with a data set that is too large to support thinking about individual data points; instead, students must think about the shape of the distribution to make a recommendation about whether a baseball diamond or a number of basketball courts will attract greater number of younger visitors to the park. Once again, the students are positioned to pose arguments based not only on their analyses of the data, but also their reasoning about that data in the context of the problematic situation that they are asked to address (consequential engagement). Specifically, although it is clear from the data that more people desire a baseball field, the people that want a basketball court are younger by two years. So, at this point, the player experiences the important point that choice of
measure of central tendency provides a lens that biases a particular perspective. This activity also afforded procedural engagement by practicing the use of particular tools, such as calculating the mean or determining the quartile values, and conceptual engagement by requiring that students explain how their analysis led to their recommendation. When students return to the world after making their final recommendation, they have an opportunity to reflect on how their choices impacted the city by observing the changed city (which is responsive to the choices the students make in game) and considering whether their recommendations made the city a better place to live.

Cheshire Academy

The purpose of the Cheshire Academy unit is to support pre-service teachers to both understand the formal concepts being taught and develop an appreciation for those situations in which what is being taught has value. Teacher education is especially significant, as we are supporting future practitioners who need to do more than master information, but be able to use it flexibly in their practice. Teaching is a complex skill that requires constant problem solving and decision making. From small moments when students suggest unanticipated ways of thinking about a problem, to large challenges when students continually push on established boundaries, teachers are constantly making decisions and testing theories as they attempt to meet the ever-changing needs of their students. Thus, a core challenge is to create opportunities for pre-service teachers to engage with situations that push them beyond being able to state claims and explain how theories are connected, to instead use these theories in practice as tools to make decisions about the world.

The experimental Cheshire School has just completed its first year – and it was a disaster. Even the headmaster, Nars, who tends to be more idealistic than pragmatic, understands that unless they produce a credible plan for the upcoming year, the school's funding will be discontinued. Supported by Brianna, who some say is responsible for the school existing at all, Nars has only three months to turn the school around. As part of the back story, undergraduate pre-service teachers login and are positioned as educational psychology consultants who can help save the school, primarily through revamping existing policies, making lesson suggestions, and enlisting community support. Some activities are done individually, and others require working with other classmates to gather information and negotiate solutions. As students work on particular problems, they are pushed to use the class textbook as a resource, and other recommended readings can be discovered in the virtual environments to help them develop deeper conceptual understandings.

Again, this unit was designed to support three levels of engagement by designing dilemmas whose resolution required engaging both procedurally (for example, by becoming familiar with terms and uses of theory), and conceptually (for example, by connecting theories to other ideas, or linking theories with implications). In addition, consequential engagement came through students engaging designed situations that had more than one defensible resolution, based on the ways that students (from their position as consultants) leveraged and defended different theories. Additionally, based on player decisions, the world can change to enable students to gain insight into the impact of various decisions. For example, as part of the third mission, students learn about and then make recommendations to a teacher about instructional and classroom management strategies, receiving feedback on the impact on test scores, academic interests, absenteeism, parental complaints, behavioral problems, and application transfer. As designers, here our bias comes through when we decide that more didactic strategies increase test scores and some parental support, and decrease transfer scores, academic interest, and personal valuing of the curriculum. The first task of students was to login to the virtual world portal and find Nars, the headmaster who welcomes them, then reviews the problem, and finally passes them over to Brianna who assigns their task. Whereas Nars had the core goal of “setting the problem” (Savery and Duffy, 1995), Brianna is focused on the solution and directing them to conceptual tools that might prove useful as they embark on the five class missions. She also warns them of some potential challenges, such as conflicting epistemologies of various stakeholders that they might meet and nefarious characters that wish to undermine the school's success and to
ensure that they operated within existing standardized norms. For example, students meet
two different teachers who are attempting to implement a coherent model of behavior
management and discipline for the entire school. The teachers have very different ideas
about standards for student behavior, and about how to ensure that students are behaving
appropriately. As students negotiate between these competing theories, and understand
the rationale behind those theories, they are asked to make a recommendation about what
the school classroom management policy should be, and why. As students embarked on the
missions designed to establish consequential engagement, they are exposed to additional
tools, primarily course readings, non-player dialogues, and exemplar videos, designed to
illuminate conceptual themes. The next task is to assist Mrs Dewey, the librarian, in
understanding how people learn. This mission culminates in a somewhat traditional
educational assignment, an essay, and is intended to bridge the experiential challenge of
learning in a virtual environment with the more traditional expectations of a university class.
In particular, students are asked to help guide curriculum design at the school by explaining
how people learn for Mrs. Dewey, and also to create a presentation that summarizes the big
ideas in a workshop for teachers. This presentation, rather than being reviewed by the real
teacher of record, is reviewed by other real students who provide feedback on how the
lesson impacted their understanding of how people learn.

The third mission involves conducting a deeper analysis of school records, with students
having to make links between grades, student satisfaction data, and absence rates. Then,
tying this into the course concepts of motivation, classroom management, and instruction, in
groups of three they recommend instructional strategies to a teacher and learn about the
impact of their suggestions on various outcome scores (e.g., grades, satisfaction,
absenteeism, curricular exams, and standardized tests). It is here that they iterate back and
forth, working to find what balance of instructional strategy and classroom management
strategy produce the largest impact on outcome scores. Based on these experiences, the
students then submit a brochure about classroom management principles. In this activity,
students engaged procedurally with information by examining theories of, for example,
classroom management or motivation, and demonstrating familiarity with the content
through online forum discussions or quizzes. Conceptual engagement was supported by
requiring students to connect these theories with implications by asking them to consider the
relationship between, for example, a theory of motivation, and different models of classroom
design. Finally, consequential engagement was supported by requiring that students
examining the implications of different theories in terms of what kinds of classroom designs
they supported. In this way, students were not simply applying theories to contexts, but
considering how particular theories supported some designs and not others, and the
benefits and drawbacks of these different designs.

Building on this experience, students are asked to produce a peer-mediation manual and
finally an assessment tool for analyzing conceptual understanding. The manual draws
heavily on conceptual understandings related to moral development and the assessment
tool draws on theoretical conceptions of what it means to know – a type of culminating
activity that brings together the various class activities and helps students understand what
they have learned. What was previously a fairly straightforward task, designing a test, now is
perceived as a tool that has critical underpinnings and is in part determined by assumptions
that are conceptually rich and have important practical significance. Specifically, by working
on central dilemmas about what it means to know and learn, and how notions of knowledge
get constructed through the design of learning environments and their implications for
engagement, students are scaffolded to consider how assessments can be consequential
for students and schooling, both through their design and the meanings attached to their
usage. Thus students’ procedural engagement with the content (defining types of
assessment), and their conceptual engagement (connecting their assessment practice with
their goals for classroom instruction), is able to support consequential engagement with the
question of how assessment drives classroom practice more broadly.
Conclusions

In this paper we have advanced a framework for thinking about and engaging in educational design, drawing on game-based methodologies and technologies as a means of supporting consequential engagement. Following this framework, we sought to create opportunities for consequential engagement so that students’ procedural and conceptual activity was always necessarily tied to the context in such a way that their actions had legitimate implications for the world. Game-design methodologies are particularly advantageous as they support interactive worlds where students confront purposively-created problems, develop hypotheses, and test solutions. As we have demonstrated, these spaces have the potential to not only situate content so that students appreciate the functional value of their thinking, but also empower learners to use disciplinary tools to transform the context towards ends they deem important. In the examples above, students are able to work within a context that is immediately visible, readily available, and targeted to support their engagement with particular ideas. In addition, because an entire class is working within the same context, they are able to share and contrast different ideas and opinions, supporting a full appreciation both of the power of the conceptual tools they engage, and of themselves and their peers as people who use these tools.

The described units are designed to support a trajectory of participation that involves all three levels of engagement, which are constantly working together to transform symbolic relationships. In this way, all aspects of engagement are legitimate with respect to the larger system of meaning. As Lave and Wenger (1991, p. 96) explained:

Under these circumstances [authentic application scenarios], the initial “circumferential” perspective absorbed in partial, peripheral, apparently trivial activities … takes on new significance: It provides a first approximation to an armature of the structure of the community of practice. Things learned, and various and changing viewpoints, can be arranged and interrelated in ways that gradually transform that skeletal understanding.

Throughout both units, students are positioned as agents whose task is to use information (as opposed to remembering it), which involved leveraging both procedural and conceptual tools in service of engaging and even transforming larger narratives.

Specifically, with respect to statistics, the unit is designed to specifically attune students to the issue of how to craft an argument by critically considering how different statistical tools support generating particular arguments. In this way, students are repeatedly positioned as experts who are able to leverage unique tools that enable them to make compelling recommendations. With respect to cognitive development, students are expected to translate theoretical arguments as represented in class readings into procedural moves as they developed deliverables or make in-game decisions and experience in-game consequences. In both cases, consequential engagement affords meaningful procedural and conceptual engagement, as content is inextricably tied to contexts-of-use. And, to different degrees, student decisions change their own trajectory of choices, the unfolding narrative storyline, and even those storylines experienced by other students.

Thus far, we have advanced the idea that designed contexts have the potential to support consequential engagement by establishing situations that are well positioned to support meaningful procedural and conceptual engagement. However, despite the consensus among many researchers about the importance of supporting students to learn domain content and theories through their applications, it is not clear how to best, or whether it is even possible to, organize learning environments that are successful at accomplishing this goal. Many courses attempt to contextualize content by asking students to “apply” their newly learned formalisms to a personally-meaningful situation. As instructors, we often treat this act of application to be a trivial matter of transfer, and expect that students will be able to see the relevance of their newly learned formalisms in complex situations. However, asking students to enlist a personal narrative involves assigning significant responsibility to students for conjuring a context that enables clear appreciation of the application of a particular theory. This is particularly challenging if you are encountering new content, as it is not immediately clear what elements of contexts will be related to the formalisms at hand.
Alternatively, an expert designer can conceive of contexts that will be particularly illuminative of the concepts under discussion, in order to maximize the likelihood that students will be able to recognize the relevance of their experiences. This distinction is particularly important with respect to the ways that students are able to exercise agency in their own learning. As Ratner (2000) has discussed, agency can be understood to operate within a structure. Thus, claiming that someone has “more” or “less” agency is insufficient; instead, the question is how agency can be exercised within the current circumstances (see Bordieu, 2000). When students are asked to enlist a narrative, opportunities are created to exercise agency in selecting or inventing a context. However, the extent to which students will be able to exercise agency in engaging conceptually with the examples is unclear, as enlisted narratives may not be usefully related to theories and formalisms under discussion. In contrast, asking students to engage a designed narrative creates more narrow options for exercising agency. However, with respect to conceptual engagement, students have opportunities to exercise agency by relating theories to relevant contexts, thus creating robust opportunities to engage both conceptually and critically.

We propose that supporting students’ consequential engagement with content further serves to reposition students relative to content, empowering them to use knowledge as a means of reaching important ends, rather than only remembering information for the satisfaction of extrinsic expectations. At the moment-by-moment level, games like Quest Atlantis, and units such as those described in this paper, position students in moments of interaction as players engage each other and the narrative context, which creates expectations for their obligations in the system (see van Langenhove and Harre, 1999). Such intentional design is, in some ways, more powerful than even using the real world because they can be so designed as to make particular happenings that illuminate and make particular concepts useful more likely to occur. As such, the role-play context allows students to engage in roles and actions that would not be possible in the non-game world. Therefore, when looking over slightly longer time periods, players can be positioned as being “certain kinds of people” through the emergent participant framework (Goodwin, 1990; O’Connor and Michaels, 1996) of the game, which shapes the ways that students are expected, obligated, and entitled to participate with content, with the narrative, and with others in the space. The extent to which these designed narratives are successful at supporting not only shifts in momentary positioning, but also the development of actual dispositions (Gresalfi and Cobb, 2006; Thomas and Brown, 2007) is an interesting question that deserves a closer study.

Parting thoughts

This paper has focused on the role of videogame technologies and methodologies for establishing consequential engagement through its potential to situate both procedural and conceptual understandings in contexts in which these tools can have legitimacy and consequentiality. Here, it is important to note that a focus on consequential engagement does not imply that all activity has to be related to a real world context; many legitimate activities are situated in systems of abstract symbols (Greeno, 1997). For example, mathematicians participate in activities that are situated solely in symbolic representations, but their actions are meaningful and legitimate with respect to those representations. When activity is serving to transform symbolic relationships, even seemingly “procedural” activities such as learning to simplify equations has meaning as they are impacting, and being impacted by, the system. Clearly, their work is consequential, in that they are constantly generating new understandings and changing an existing field. The problem with situating content solely in contexts of symbolic representations, however, is that everyone that uses mathematics does not necessarily have access to that system, and their mathematical activity often seems confusing or meaningless because it does not impact, nor is it pushed back by, the larger system of symbolic meaning.

The concern raised by many authors is that systems of symbolic relationships are necessarily elite and exclusive, thus systematically disenfranchising particular peoples (Walkerdine, 1997). Although we would argue that this is an artifact of the ways practices are enacted, rather than affordances of the symbol systems themselves, we agree that
Walkerdine’s concerns represent the current reality for many students who have become disillusioned with current practices of schooling (Delpit, 1988; Ladson-Billings, 1998; Ogbu, 1992). Thus, in this work we focus on contexts-of-use that have the potential to create access for broader participation. We are therefore concerned with the system of meanings in which activities are situated, and that students have access to that system and are able to use that system in such a way that their actions are meaningful and have consequence. As a consequence, in designing for consequential engagement, we do not seek to simply create an interesting context in order to coerce students to engage by hoping to sugarcoat academic content. Instead, we seek to design contexts that become affordances for students’ procedural, conceptual, and consequential engagement with the content to be learned.

At some level, this discussion assumes that students do not have a context-of-use readily available as a tool for thinking about new formalisms. However, it is possible that, with experience in the real world, the importance of designed worlds fades. Preliminary analyses of a graduate level course that contrasted students who participated in a designed narrative (a multi-user virtual environment version of the course) with a more traditional online version of the same course, suggested that enlisting personal narratives in discussions of theories and formalisms often led to richer explanations than engaging with designed narratives. Indeed, the enlisted narratives that were discussed were robust and well-aligned to the theories under discussion, and potentially were discussed at a deeper conceptual and even consequential level than was the designed narrative that we introduced. This suggests that for learners with a rich history with situations in which the course content has relevance, enlisting designed narratives might not be as fruitful. Future research will examine this issue more closely, by considering the role of students’ histories of participation on their enlistment of rich contexts.

In closing, we have discussed how to support students to engage in situations that allow them to use conceptual understandings as tools for gaining insight into and solving meaningful problems. Reciprocally, we have discussed how conceptual understandings illuminate aspects of contexts that might not be visible without such understandings and that help deepen one’s conceptual understandings. In so doing, we have discussed our goal of supporting students to develop different relationships with knowledge through three levels of engagement: procedural, conceptual, and consequential. Beyond supporting the reader’s conceptual engagement with the ideas, we instantiated this discussion in design stories to support procedural engagement and then finally attempted to show how this provided a transformative context for learning statistics and educational psychology respectively. It is our hope that the reader is then able to enlist their own future narratives in which they take what they learned through this manuscript and transform contexts for learning; thereby, exercising their own consequential engagement with the ideas expressed herein.

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