Creating Context for Educational Research in Virtual Worlds: 
An Invitation to Dialogue

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ABSTRACT

Educational practices in virtual environments provide novel promises and challenges in scholarly investigation and application across the disciplines, while the rapid proliferation of virtual worlds’ technical advances and the growing scope of their educational value pose problems for research synthesis. However, the need for scholars to explore and describe the boundaries, contexts, and conditions of this field is pressing. This article attempts to frame the space for “critical discourse” in the field, using the set of exemplary works from researchers presented in this special issue of the IJGCMS to initiate an open, systematic, and ongoing effort to identify key dimensions and related questions for educational research in virtual environments. To provide an appropriate infrastructure for future research, the authors call for the collaborative dialog among scholars in educational virtual world research to construct a common evidence base of both practical and theoretic value using principles of fuzzy logic and social networking technologies.

Keywords: AERA, ARVELSIG, Collaboration, Definition, Educational Research, Immersive, Virtual Worlds, Web 2.0

INTRODUCTION

In this special issue of the International Journal of Gaming and Computer-Mediated Simulations we provide a compilation of the top five papers as rated by reviewers and executive officers of the Applied Research in Virtual Environments for Learning Special Interest Group (ARVEL SIG), presented at the 2009 annual meeting of the American Educational Research Association (AERA). Also included in this issue is an invited book review, as well as this introduction that serves as an overview and an invitation to scholars to continue an ongoing dialogue on educational virtual world research practices.

OVERVIEW

In our first year as a fully operational SIG, we sought to assist members to frame a collective educational research agenda in this emerging field of study by creating a call for proposals that solicited operational definitions of virtual worlds (VW) and immersive virtual environments for
learning. The collection of papers in this special issue explores the larger context of VW research, the definitional boundaries of immersive virtual environments, learners and teachers who utilize them, and implications for a 21st century curriculum. Though not intended to be comprehensive in defining VW, each paper illuminates important facets for us to consider in this process.

**Context for Educational Virtual World Research**

Over 97% of American teens report they play games, and their gaming experience is rich, varied, and involves significant social interaction (Lenhart, Kahne, Middaugh & Macgill, 2008). In particular, strong attention is given to VW by commercial interests, entrepreneurs, and the news media. Development of these immersive spaces for playing, working, and learning is increasing with predictions of over 800 virtual worlds by 2012 (KZero, 2009), and 80% of Internet users in a VW by 2011 (Gartner, 2007). Current registered user accounts in all virtual worlds listed are currently estimated at 671M (KZero, 2009).

Researchers have been exploring the potential and promise of VW since the early 1990’s (Morningstar & Farmer, 1990; Winn & Bricken, 1992). However, scholarly attention on uses of VW as an educational medium, though sizable, has arguably failed to keep pace with such proliferation of these educational applications. In particular, we are still in the early stages of research on the use of multi-user virtual worlds to support formal learning and knowledge development. More overarching, substantive educational research questions are presented by VW than there are meta-analyses or comparative studies to assist in developing common frames and findings upon which to develop the field as a whole.

Beyond VW, the educational research community is generally unprepared to deal with the vast and sweeping technological changes increasingly permeating our social institutions and communities (Borgman, 2007; Dede, 2009). Our data sharing and collaboration infrastructure, discipline-specific nomenclature, and the insular scholarly communities are ill-suited to effectively and proactively position us to embrace the broad scale social and technical changes just on the horizon and impacting society at an exponentially increasing rate (Kurtzweil, 2005).

Educational researchers who focus on practices in virtual environments face exciting opportunities, but also new types of challenges. On the one hand, we have an emerging type of educational technology with immersive capacities that provide learners with potential for new kinds of community and a sense of “being there” (Cummings et al, 2008). This has many powerful implications for teaching and learning across the disciplines and may also enhance and extend educational research in ways that we can only begin to imagine.

On the other hand, in addition to aligning these new types of interaction and experience with what we already know about the development of meaningful learning experiences, virtual worlds for learning have many “layers” of evolving complexity (Warburton, 2009) with which learning scientists must contend. We are at a crossroads, challenged to make sense of new complex phenomena using new tools under dynamic conditions with scarce resources (Borgman, 2007; Dede, 2009).

A systematic inventory of the current technical, methodological, and pedagogical frames relevant to the conduct of research performed within VW would be a substantive contribution. Such an inventory would ostensibly position educational research in virtual environments as a nascent field and move beyond a collection of “bottom up” investigative studies. As a step towards such an inventory, this introduction endeavors to articulate recurring themes illuminated through these exemplar papers. We contrast these themes to the hallmarks of good educational research as feasible in the current context of educational scholarship on virtual environments. In the classic tradition of research, historical precedent would have us posit a single comprehensive survey or similar act of framing. Within this field, however, we believe at present a collectively developed infrastructure and process, repeatedly iterated, is more appropriate than a single collectively developed infrastructure and process, repeatedly iterated, is more appropriate than a single snapshot in time developed by just a few scholars.

There are many outstanding additional educational studies investigating virtual environments that we have not reviewed or included in this framing and discussion of the need for common constructs, boundaries, and definitions for this sub-discipline. Our hope is that this special issue can serve as a starting point for researchers in
virtual learning environments to converge on a conceptual framework of research practices with sufficient precision and scale to delineate VW learning opportunities. Thus, the articles presented within this issue provide a purposefully selected sample set of exemplars to start an evolving “critical discourse” space for our field.

The Necessity for Operational Definitions

Of central importance to educational researchers is defining the boundaries of the subject of study. What is an “immersive virtual environment” or a “virtual world?” When used for learning, a virtual world is a genre of educational simulation (Aldrich, 2007) defined by Bartle (2004) as a self-contained environment where “the imaginary meets the real” (p.1).

Virtual worlds are a unique form of technology in that students can learn by literally constructing their knowledge in 2D and 3D representations such as objects, places, buildings, and interactive media.

Other definitions of VW illuminate additional operational traits:

- Internet-based immersive simulation environment, not a game, utilizes an avatar to move through space, interact, socialize, and build (Dawley, 2009).
- Online computer-generated environments that can be accessed by up to millions of people at the same time (Castronova, 2005).
- A social networking platform, 24/7 availability, with distributed access from different location, used for identity exploration and relationship building (Kafai, Fields & Searle, in press).

While there exist concrete definitions of VW, other scholars have explored the variety among definitions and potential resolutions to the inconsistency among these definitions (Bell, 2008; Warburton, 2009), including proposing typologies and comparisons of features and attributes across platforms. However, the need for common operational definitions to move the field forward still exists. For example, some might distinguish a virtual world from a massively multi-player online role-playing game (MMORPG), such as World of Warcraft (WoW), but others might argue that WoW is an MMORPG hosted in a virtual world environment. Still others prefer terminology such as MUVE (multi-user virtual environment) or immersive virtual environment.

The question remains as to how to best determine the characteristics that define educational research in virtual worlds as a collective Community of Practice. Because these rapidly multiplying, constantly evolving digital environments support diverse milieu with different user interfaces, affordances, purposes, and designs, the need for the educational research community to delimit the range of study to a set of common characteristics that define the field is pressing. Consider the variety of:

- Technical terms for describing the interface, function, structure, and construction of different virtual worlds (e.g. “prims,” “group chat,” “rezzed”, etc.);
- Social processes that emerge as a consequence of people using these interconnected 3D digitally plastic social spaces (e.g. clans and groups, gender bending, griefing, gold farming, professional networking, etc.);
- Varieties of learner engagement within VW (e.g. roleplay, collaboration, construction, media presentation, formative assessment, etc.).

Without a definition of what “is” a virtual world and what “is not”, there will be potential conflict, confusion, and effort spent on definition of terms - where focused use of healthy methods to determine the efficacy of these environments for learning would be better spent. In today’s world of research databases, a lack of common terminology may result in some studies relevant to the field mislabeled and lost in the depths of some database never to enter the conversation.

Identification of successful key features in small-scale educational designs is also requisite for transfer to large-scale projects (Dede, 2005). This identification and reporting of key features may be more confusing than useful if the researcher is unable to articulate these features in relation to a larger context. For example, a researcher may come to significant conclusions about the use of text-based chatting in a VW that only al-
lows text chat. This conclusion may be less than meaningful in a platform that also provides the ability to voice chat.

The definition dilemma was also made evident with the first inquiries once the 2009 ARVEL Call for Proposals became available. Questions around definition immediately arose, “I’m doing educational research on a first-person shooter game, does that count?” or “My research is in Whyville, a 2D virtual world, will you consider my proposal?” Most SIG members were clear that immersive 3-D environments such as Second Life and ReactionGrid are VW, and more established online learning systems such as Blackboard or Angel, or social networking tools such as blogs or wikis, are not VW, our boundaries became less clear when faced with defining 2D virtual environments, augmented realities, or other forms of quasi-immersive virtual learning.

This lack of common operational definitions is not surprising given a number of factors: the high degree of functional variation between VW platforms, the incredible structural plasticity and degrees of behavioral freedom possible within these milieu, and the rapid emergence and evolution of new tools and feature sets within the VW industry. Add to these complications the differences in disciplinary terminology from the various schools of thought that have weighed in the effectiveness of VW in education and the prospect of a common agreement can look disastrously untenable. Sociology, psychology, education, informatics... each discipline has its own specialized terminology and theories. When the multidisciplinary domain of VW research merges to attempt to create a cohesive conversation, incommensurate terms reveal themselves as conceptual gaps and disconnects within the conversation. This may be a necessary result of research in complex topics that scholars must accept. Nevertheless, the authors posit that some degree of agreed upon structure – whether framework, guideline, and/or process – is both necessary and desirable for educational research in virtual environments to advance as a field.

Currently, each independent research endeavor that portends to study educational efficacies or potentialities in virtual environments must work with multiple conceptual and epistemological frames, boundaries, and intersections between and amongst the dimensions of the work. This creates a chaotic and rather unwieldy foundation on which to build a systematic evidence base to inform research, theory, or practice. Without common definitions, we cannot arrive at common measures for contextual variables that would allow us to compare our research results. Indeed,

...to advance what we understand about technology use and effects, the results of multiple, contextualized evaluations must be combined and accumulated. The intent of such an effort is not to find uniform results but rather to aggregate findings across studies to enable inferences relating features of contexts to successful or unsuccessful implementations and degrees of impact (Means & Hartel, 2003, p. 260).

In order to perform such a meta-analysis, we believe that a priori research community efforts to align and contextualize the discipline would be vastly preferable to the foreseeable alternatives.

### Central Questions For Defining Educational Virtual World Research

Rather than seek concrete definitions to “what is a virtual world,” which requires an answer that is fixed in time, limited to the needs of a particular audience, and almost guaranteed to be out-of-date by the time it is published, educational researchers may find it more useful to first identify central questions in educational virtual world research. Collaborative groups of educational researchers familiar with VW contexts and conditions might then work together to determine common language and definitions for dimensions with a high degree of common structure or function. Examples of domain questions that span VW common to and of interest to educational research practices across disparate areas of inquiry that would benefit from collaboratively defined terminology and boundaries are:

- What are “virtual worlds”?
  - What is the technical and functional terminology for VW and the operations that may be performed within them?
What is the interpersonal terminology of people acting within virtual environments as dialogic “places” within which students experience, act upon and have a sense of agency?

- What is the central purpose of educational research in virtual environments?
- How can we best frame ontological definitions and terms referring to “being” within VW and resonances with the physical world?
- How can we best frame epistemological definitions and terms to refer to “knowing” in VW and its relationship to and across boundaries to the real, or physical world?
- How should we best frame methodological contexts for studying and designing virtual environments?

Virtual Worlds: A Spectrum of Virtuality

There are many ways of being virtual and more everyday. The question of “what qualifies as a virtual world?” the answer to which implies varying degrees of importance. With varying degrees of virtuality, where do we draw practical and ideal boundaries to effectively allow a disciplinary field to work toward an emergent, common understanding? The very concept of virtuality, reality somehow influenced and augmented by digital attributes, has shifted over the past fifteen years from a concept about multi-sensory hardware to immersive visual and social environments. The kinds of digital augmentation once only possible with considerable hardware are now possible with a mobile device such as an iPhone. Virtuality may soon shift from concepts of avatars in VW displayed on screen to a description of a life constantly augmented by layers of data fed directly from one’s environment via clothing and other non-invasive or location-based devices. This shift is made evident in augmented reality, 3D worlds on a screen, and embodied digital spaces such as SMALL Lab, described by Birchfield, et al, in this issue. It’s possible that what we currently refer to as a the “real world” may at some point become more virtual than the worlds we see on screen. The conflict between narrow operational definitions and conceptions of virtuality flexible enough to accommodate the rapid shifts in available technology is both an obstacle and an opportunity.

A possible guiding mechanism for researchers in virtual environments is to conceptualize multiple decision-making criteria to answer the question of “what is virtual?” and apply a fuzzy logic method (Salmani & Akbarito, 2008) to determine “Degrees of Virtuality.” Borrowed from the field of Sustainable Agriculture, also faced with multiple, nonordinal dimensions to align and justify, fuzzy logic attempts to incorporate and systematically contextualize a number of disparate, but important variables, including a treatment of noncommensurate units, a ranking procedure for a solution and to ascertain the degree of discrimination between attribute values (Marks, Dunn, Keller, & Godsey, 1995).

Figure 1. Degrees of virtuality as measured by percent affected and extent of virtuality (Adapted from Intelligent Essays, http://bit.ly/kgB2w)
Such a system might be constructed for use by the field by researchers in the field and applied in comparing and contrasting the relative efficacy of educational efforts in virtual environments. The authors submit that such a system, if implemented with clarity, openness, and by a sufficient number of researchers comprising the breadth of the educational virtual worlds research field could effectively provide a structural mechanism necessary to contend with the increasing complexity found within this field of inquiry, while remaining flexible enough to accommodate individual research needs and adapt with the ever-changing nature of the technology and its applications to learning.

Take, for example, the very idea of “virtuality” and its implications to the field of educational research. Below are a few of the suggested features of virtuality that appear to be of current importance to educational researchers.

1. Intentionality within VW architecture (game, open environment, collaborative, competitive). While this intentionality may radically influence the educational experience, it may not be as germane to determining the “degree of virtuality” as some of the other features described below.

2. World presentation modes (text, graphic, sound, movie, web, haptics): In this issue, stigmergy refers to the ability to create lasting content and its capacity to affect subsequent visitors by those objects within the world despite the (temporal) absence of the creator. Jones & Bronack (2007) leverage this understanding to describe the creation of educational persistence in virtual worlds through the informational artifacts left in the world to guide new learners.

3. Avatar customizability (none –> extreme): An avatar typically serves as the main form of media access to virtual environments (Trepte, Reinecke & Behr, 2009), and influences questions of embodiment and identity in learning.

4. Learner communication channels (chat, IM, group, voice, external access): Interactivity between users is a critical requirement for establishing telepresence in a multi-user environment. The ability to easily share information with others contributes to successful play in games worlds and lends to the sense of “immersiveness” by projecting a sense of others with the representation of yourself (i.e. your avatar), through building social connections, information sharing, and emotional responses. Dawley (2009) identifies over 20 forms of communication mechanisms afforded by virtual worlds.

5. Capacity for and function of group membership: Community networks serve powerful social needs of virtual world learners, including the ability to contact friends and colleagues, participate in social, educational, and political activities, and to create channels for mobilizing around learning related efforts. Most virtual worlds provide functionality for group creation and both synchronous and asynchronous contact.

6. Object construction, manipulation & ownership: Students interacting in some virtual worlds have the added benefit of being able to build and own representations of their knowledge. Doing so allows them to compare and contrast their concepts with existing knowledge in graphical form – an especially important capability when learning content of certain domains with a high degree of visual information (Keating et al., 2002; Clarke & Dede, 2005).

For each dimension, we might over time and in different contexts answer this question as best we can: How might we “weight” these on a fuzzy logic scale in a balanced and proportionate way reflective of the educational research at hand?

Each of the above features may be of relative importance to a particular educational research question or even found as capable within a given virtual worlds platform – while not as prominent to another research problem or virtual worlds interface. By creating a public set of common virtual worlds features that spans the current domain of virtual worlds research problems and technical platforms, these relative, or “fuzzy” perspectives may concatenate over time to provide the research field with a purview of “virtuality” and its many permutations. This ideally exhaustive set of features for each dimension might also, then in turn found valuable to many researchers looking at the issues to define the problems, themselves.
Table 1. Scale of virtuality features considered by educational researchers

<table>
<thead>
<tr>
<th>Feature</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intentionality</strong></td>
<td>Conditional</td>
</tr>
<tr>
<td><strong>Presentation Modes</strong></td>
<td>Text</td>
</tr>
<tr>
<td><strong>Avatar Customization</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Communication Channels</strong></td>
<td>Text chat</td>
</tr>
<tr>
<td><strong>Group Membership</strong></td>
<td>No groups</td>
</tr>
<tr>
<td><strong>Object Creation</strong></td>
<td>None</td>
</tr>
</tbody>
</table>

| **Collaborative**               | Graphic                     |
| **Audio**                       | Moderate                    |
| **Voice Chat**                  | Local Chat                  |
| **Restricted Group formation**  | Open group formation        |
| **Limited within pre-programmed options** | Full range using scripting provided by developer |
| **Full range using scripting provided by developer** | Open source product, full object creation and ownership |

Purpose of Educational Research in Virtual Worlds

For our nascent field to gain and maintain quality and relevance, educational research in virtual environments needs to remain “educational” (Ball & Forzani, 2007). While the lived experiences of teens in Whyville, or the experiences of students who collaborate in augmented reality, and the value and meaning that we ascribe to “being there” in VW are arguably important—even germane to educational research in virtual environments—the orientation of our scholarship needs to be focused on ascertaining and highlighting the value of these virtual environments for specific educational outcomes. This boundary will allow our community of scholarly practice to remain relevant and to stay focused.

The virtual learning research field has matured somewhat beyond discussion of the mere possibilities, and into the realms of application and findings. This is to say, the question of “if” VW will have a substantive influence on learning in general appears to be a question of the past. Now, with growing evidence that these virtual environments do indeed hold potential and application for real learning gains, our focus as a sub-discipline now is shifting toward “how?,” “why?,” “under what circumstances?” and “for which populations?” In this issue, Caperton provides us with an overview of how literacy and learning happen in virtual game environments, and Kafai identifies tween flirting behavior and considers implications for management of the VW environment. Now the onus lies with researchers to ascertain how best to measure and apply these influences at a finer grain and collectively illustrate these contexts. While the articles here represent important contributions to this process, we anticipate that the field will become ever more innovative in its attempts to capture in controlled research the true impacts of the applications of such technology within and without the classroom.

Ontological Definitions

What does it mean to “be” in a virtual world, and how does this experience resonate with life in the physical world? The nature of “being” appears to be rather an elastic construct in VW. For example, how might researchers determine the degree of “being” in a virtual world in an educational simulation? In this issue, Barab, et al focuses on designing situated contexts so the virtual environment becomes responsive to learner action. In Quest Atlantis, “being” thus implies one becomes a key decision maker who applies disciplinary knowledge. Gibson’s review encourages us to consider the boundaries of virtual worlds, and the opportunities provided to explore identity, power, and layers of freedom. Although “being” in a virtual world can appear to offer limitless potential, he also asks us to reflect on real life consequences for learners.

Scholars are increasingly researching experiences across and between different dimensions of learner experiences between virtual and real-world environments. Case studies and related qualitative
descriptions of such “mixed reality” experiences are to date the most common methodological frame through which to examine such phenomena. In this issue, Birchfield, et al provides an excellent example of cross-domain learning in this issue when describing students interacting with the GeoCake. Others explore the boundaries of cross-domain learning in studying narratives developed in the virtual environment, and how those might apply in real-world settings (Halverson, Wolfenstein & Dikkers, 2009). While these are appropriate and necessary contributions to a field just apprehending these new human situations, they are insufficient for us to arrive at a larger perspective, one that might allow us to abstract general principles about cross-domain learning.

Epistemological Definitions

What assumptions about knowledge do we make as researchers in order to frame and engage in systematic inquiry about how people learn in virtual environments? How we know and acquire knowledge, and how researchers determine what people “know,” can vary in the virtual world just as it does in real life research contexts. In virtual worlds research, some are interested in what students are learning as a result of authentic virtual world activities and game play, e.g. new media literacies (Jenkins et al., 2006), or informal scientific reasoning (Steinkuehler & Duncan, 2008), and how that learning carries into “real life.” Research into learner’s experience, such at Nelson’s et al examination of cognitive load in 3D learning environments, and Kafai’s questions on tween socialization help us see the virtual environment from the perspective of the student. Other researchers might choose to focus on leveraging the virtual environment to employ known pedagogical strategies such as roleplay or collaborative group learning, or developing emerging pedagogical frameworks (Dawley, 2009). Collaborative dialogue around the nature of teaching, learning, and teacher education in virtual worlds can illuminate the common and not-so-common epistemological dimensions to which we seek answers.
environments, we sense that these are still the early days; that we are just at the beginning of a rich and storied dialogue of collaborative inquiry. As time passes and virtual environments become more ubiquitous with more germane applications to human awareness and knowledge, we presume to validate that these are worthwhile objects of study for educational research. VW allow us to experience things that we cannot otherwise experience.

Dede (2009) suggests that we use an interconnected suite of web 2.0 technologies to generate communal knowledge and wisdom, and in doing so, respond to the required pace and quality so needed in modern scholarship. Consider the advice offered by a gathering of social scientists at an NSF workshop for a related field - those researching and evaluating virtual organizations “...participants believe that VO researchers should consider as they move forward in a partnership. These include issues of definition, comparative frameworks, lifecycles, diversity, codifying research knowledge, technology for knowledge and data sharing, collaboration within and across disciplines, technology-mediated interaction, scaling, motivation, governance, metrics and assessment, and logistics” (Cummings, Finholt, Foster, Kesselman, & Lawrence, 2008).

The use of a collaborative web space or wiki for developing the terminology and coming to an agreed upon set of principles may be a great step forward for the educational research community in virtual worlds. By mapping the landscape of the interdisciplinary research field together and collaboratively populating nested hierarchies of principles with research studies that descriptively encompasses the known body of work across the field of educational research in virtual worlds, the community can advance. Fuzzy logic provides one mechanism for looking across the field. Virtual worlds researchers may also look to the example of LearnLab, the Pittsburgh Science of Learning Center, which appears to serve learning scientists well by coordinating the development of a unifying conceptual framework (http://www.learnlab.org/research/wiki). The Applied Research in Virtual Environments for Learning (ARVEL) Special Interest Group at AERA has a wiki created for a parallel purpose (www.arvelsig.com) for virtual worlds research, though it will require the collaborative efforts of sufficient research professionals for it to develop further as a useful resource. As our response to the need for developing web 2.0 communities to explore questions of virtual world research, we would like to leave with a call for participation to join us in ARVEL SIG activities http://arvelsig.ning.com/, and assist to create a future-focus in educational virtual world research by developing common definitions, sharing research, tools, and methodologies, and developing our outreach online and in multiple virtual world environments.

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