Recommendations for Designing Effective Learning Events in 3D Virtual Worlds

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ABSTRACT

3D Virtual Worlds hold great potential for delivering situated and collaborative education and training. Designing instructional events for virtual worlds, however, requires new competencies for even the most experienced instructional systems designers. The environments, the courses, and the interactions are limited only by the imagination of the instructional designers and their support teams—opening up an array of new opportunities for learning. Since their inception, Robert Gagné's Nine Events of Instruction have been used as a model for many types of training and a variety of learning modalities. The increasing popularity of virtual worlds raises the question of whether or not Gagné's events currently are, or can be, applied to training sessions delivered in 3D Virtual Worlds. This paper reviews Gagné's Nine Events and examines the use of these events in training sessions offered in 3D Virtual Worlds. In addition, this paper addresses best practices and recommendations for designing 3DVW training courses by investigating the applicability of classic learning theory to this new instructional medium.

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Trey Reyher is a systems administrator for a number of virtual worlds including Second Life Enterprise, Open Wonderland, VastPark, and OpenQwaq. He served as the technical subject matter expert on virtual wargames delivered to the Air Force Research Laboratory. Prior to beginning his consulting career, he worked in the commercial and academic video games industries. In the former, he produced interactive games; in the latter, he developed research-oriented games at the Massachusetts Institute of Technology, from which he received a Bachelor of Science degree in Brain and Cognitive Sciences.

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INTRODUCTION

3D Virtual Worlds (3DVWs) hold great potential for delivering situated and collaborative education and training. Designing instructional events for virtual worlds, however, requires new competencies for even the most experienced instructional systems designers (ISDs). The environments, the courses, and the interactions are limited only by the imagination of the instructional designers and their support teams—opening up an array of new opportunities for learning. This paper addresses best practices for designing 3DVW training courses by investigating the applicability of classic learning theory to this new instructional medium.

In the fast-paced world of technology-based learning, ISDs cannot afford to become complacent. Over the past decade, ISDs have negotiated the path from instructor-led training using videos, computer-based trainings (CBTs), e-learning, blended learning, and synchronous web-based learning environments. As the availability, success, and variety of 3DVWs continue to increase, ISDs have an opportunity to create successful learning in this new, immersive, and highly engaging medium.

The potential to achieve successful learning outcomes using 3DVWs is immense. The environments allow learners to become immersed in scenarios where they can make meaning from the experience itself (Kapp & O'Driscoll, 2010). Virtual worlds offer worldwide users the benefit of synchronously testing concepts and ideas in the simulated environment, without the geographic (and other) constraints of the real world. They allow users to practice making decisions and to improve on those decisions as they "make meaning." Physics, physical limitations, and risks disappear in virtual worlds, affording users the opportunity to observe, participate, and co-create with peers with only the boundaries that may have intentionally or inadvertently been built into the virtual world (Holden, Westfall & Gamor, 2009).

APPLYING GAGNÉ'S THEORY TO TRAINING ENVIRONMENTS & MATERIALS

Robert M. Gagné (1916–2002) was an American educational psychologist who greatly influenced the field of instructional design. His research in learning and instruction helped shape educational theory as well as military and industrial training. Gagné was among the first to develop a theory of instructional systems design. He proposed that a lesson can be broken down into Nine Instructional Events (see Table 1). Although factors such as individual differences, motivation, and time on task can affect learning outcomes, instructors who integrate an appropriate combination of these Nine Events into their lesson plans are more likely to ensure achievement of specific learning outcomes (Gagné, 1965).

Table 1. Gagné's Nine Events

Gagné's Nine Events of Instruction
1. Gain attention
2. Inform learners of the objective
3. Stimulate recall of prior learning
4. Present the stimulus
5. Provide learning guidance
6. Elicit performance
7. Provide feedback
8. Assess performance
9. Enhance retention and transfer

It is difficult to overestimate the impact Gagné has had on instructional theory. Although his has not been the only important voice in shaping the field, it has been an enormously influential one by virtue of the prodigious volume of original work (Smith & Ragan, 1996).

It has become common practice among instructional designers to incorporate some or all of Gagné's Nine Events into instructional materials and training strategies despite the variety of instructional methods that are now available. Although Gagné's original

research focused on face-to-face training sessions with live instructors, subsequent researchers applied Gagné's Nine Events to web-based, learner-led trainings. The following studies highlight different ways in which Gagné's research was applied to new media.

Recall and Conceptual Learning. Bassoppo-Moyo's (1996) study on the effects of pre-instructional activities in enhancing learner recall and conceptual learning was based on the first three of Gagné's Nine Events – gaining attention, informing learners of the learning, and reminding learners of prior learning. Instead of studying the instructor's verbal cues to measure Gagné's first three events, researchers turned to written pre-instructional materials. In general, the findings indicate that of all the pre-instructional materials examined and correlated to Gagné's Nine Events, written performance objectives may have the most beneficial effect on learning.

Asynchronous Training. Another set of research studies applied Gagné's Nine Events to the design, rather than evaluation, of asynchronous training. A web-based course was developed based on Gagné's initial three events of instruction: acquire attention, stimulate recall of prior learning, and present the stimulus content (Zhang, Zhang, Duan, Fu, & Wang, 2010). To draw the trainees' attention, researchers constructed an interactive course navigation menu on the first page of the course. Frequently repeated hyperlinks of prior terms and concepts encouraged the trainee to recall information learned in the past. The designers incorporated Gagné's third event, presenting the stimulus, by allowing the trainee to choose different steps in the process and thus control the pace of the web-based information flow. Results of the study indicated that human-computer interaction and animation features of the e-learning course positively influenced the learning result and psychological process of learning, including the learner's cognitive perception and methods of organizing information. Again, this study shows how creative interpretations of an asynchronous lesson were constructed based on three of Gagné's Nine Events.

Web-based Application. Similarly, a study by Teoh and Neo (2007) used all of Gagné's Nine Events of Instruction to build asynchronous, student-centered, web-based multimedia lessons as substitutes to weekly traditional lectures. Over a 14-week period, students used a web-based instructional approach to independently learn information while engaging in online consultations with tutors. Grounding the interactive learning in Gagné's Nine Events may have affected the positive findings of students towards this type of interactive, self-paced learning.

Face-to-Face Teaching. Another group of studies used Gagné's Nine Events to evaluate face-to-face teaching methods. Hampton and Reiser (2004) designed a student survey to rate teaching assistant's performance by how carefully they followed Gagné's Nine Events of Instruction. In addition to reviewing student survey ratings, teaching assistants in the experimental group received a personal consultation or review of their rating based on Gagné's Nine Events. They found that Gagné's seventh instructional event, giving informative feedback, had a significant impact on instructional practices and ratings of teaching effectiveness. However, student learning and motivation fluctuated, depending on the frequency with which instructional activities were applied. Studies such as this support Gagné's original finding that one or more of the Nine Events can positively influence instructional practices and increase teaching effectiveness.

In summary, this review of the literature shows Gagné's influence on designing and evaluating various types of training environments, and the potential for improving trainee's retention and experience by incorporating these Nine Events into instructional design practices.

DATA COLLECTION METHODS

The review of literature and research studies confirmed the acceptability of using Gagné's Nine Events as a model for designing different types of training events. Considering the relatively new training modality of 3DVWs, this paper looks at 3DVWs to assess the way in which the designers of these courses incorporated Gagné's events in their design.

To this end, four 3D Virtual World training courses were assessed, using the following data collection methods:

- Four targeted observations of training sessions conducted in three unique 3DVW environments using four observers
- Three demonstrations or tours of 3DVW training environments
- Review of training materials, read-ahead documents, and facilitator guides
- Post-course surveys
- Participant interviews
- Three structured interviews with instructors, subject matter experts, and designers

3D Virtual Worlds Studied

Using the methods listed, the following training courses were reviewed.

1. Negotiating with the Three Ps: Prepare, Probe, and Propose (Negotiations)

Mark Jankowski of Shapiro Negotiations Institute, in partnership with Virtual Training Partners, conducts Negotiations Skills Training (see Figure 1) in both Second Life and Virtual U. In these instructor-led programs, trainees are taught a systematic process for negotiating with suppliers, vendors, customers, and peers that enables them to maintain an ongoing business relationship.

The target audience for this course includes a wide variety of "digital natives" and "digital novices" interested in improving their negotiation skills. The course is approximately six hours of seat time with assignments or homework between the sessions.

For this study, four sessions of the training were observed; two each in Second life and Virtual U. Each session included 8-11 participants. In addition, the curriculum design was discussed with the course creator, Mark Jankowski. Trainees from these sessions as well as trainees who completed the course prior to this study completed subjective-response surveys.

Figure 1. Screenshot from 'Negotiating with the Three Ps' in Virtual U

2. T2 Virtual Post Traumatic Stress Disorder (PTSD) Experience

Dr. Kevin Holloway, Psychologist, National Center for Telehealth and Technology (T2) and his team created an immersive, interactive learning event to educate both people afflicted with PTSD and their loved ones about combat-related PTSD in Second Life (see Figure 2).

Available to the public, this asynchronous event demonstrates how PTSD may be acquired, the symptoms of PTSD, and how PTSD is a normal human response to traumatic events. The environment includes simulations of PTSD symptoms, helping the visitor learn through interactive activities how PTSD symptoms impact a person's life. The environment also includes information to help visitors determine if someone is in need of care, and how to access the appropriate care.

Figure 2. Screenshot from Virtual PTSD Experience Training

For this study, two separate tours were conducted with Dr. Holloway and his design team. Structured interviews were performed with Dr. Holloway, the design team, and site visitors.

3. Air Force Research Laboratory Wargame Series (Wargame)

Booz Allen Hamilton created a series of scenarios in conjunction with the Air Force Research Lab (AFRL) to apply knowledge and processes that center on the use of military tools and humanitarian aid within a realistic 3DVW in Teleplace (see Figure 3). The challenge was for a team of operational commanders to rapidly develop, implement, and refine their strategies for reducing hardship on the population of an unstable region with the support of a tool called the National Operational Environment Model (NOEM).

Figure 3. Screenshot of AFRL Wargame Environment

For this study, one live wargame interaction was observed and a tour was conducted of the 3D environment by game designer Jonathan Compton. In addition, the read-ahead materials were reviewed.

4. Department of Homeland Security (DHS) Critical Infrastructure Key Resource Asset Protection Technical Assistance Program (CAPTAP)

Designed by Engineering & Computer Simulations (ECS), the CAPTAP program (see Figure 4) is used by DHS to complement traditional classroom training. The goals are to improve retention and to enhance transfer of knowledge to the job. In this 3DVW, built in Nexus 1.3, participants engage in a Virtual Asset Assessment Field Trip in which they must apply the information learned in the classroom to a realistic scenario.

Figure 4. Screenshot of DHS CAPTAP Virtual Field Trip

For this study, the facilitators guide and read-ahead materials were reviewed and a guided tour of the 3D environment was conducted.

RESULTS

Based on the data collection methodologies noted above, the following observations were made on the use of Gagné's Nine Events in 3DVWs.

Event 1 – Gain Attention

Gagné's first event, gain attention, is an important design element in the 3DVW courses observed. In Negotiations, the instructor led the participants through a variety of environments related to the learning material. Both the DHS and the Wargame courses visually immerse learners in a content-appropriate environment where they engage in scenario-based challenges. Although it can be legitimately argued that immersion alone is insufficient to gain attention, the authors suggest (feel?) that VW participation requires a

baseline level of engagement, and it is immediately obvious if participants are not paying attention.

The PTSD environment, although an asynchronous learning environment, gains the attention of participants to some extent by creating an inviting environment and piquing their curiosity by using the metaphor of a state park visitor's center. Asynchronous environments, like the PTSD experience, are more challenging environments in which to gain participants' attention because there is not an instructor present.

One of the drawbacks to using 3DVWs as a delivery platform is to maintain attention, rather than allow participants to be distracted by the elements of the environment. During the observation sessions, several participants were seen to be changing clothes in the midst of a training event or flying around while the instructor was talking. It is important in the 3DVW learning events to maintain attention as well as to gain it.

One clear challenge in building virtual world training environments is striking the right balance between allowing learners to immerse themselves in the virtual experience while managing the immersion so learners fully benefit from the experience itself. Gagné suggested matching the attention-getting stimulus to the lesson (1965). If instructing students on safe driving methods, he wrote, begin the lesson by showing students a scene from a shocking accident. In much the same way, researchers believe getting the attention of students in a virtual world learning environment should match the attention-getting stimulus to the content. An instructor-led environment might engage students by immersing them in a learn-by-doing environment. For example, requiring avatars to act in some form is one method for commanding students' attention.

Event 2 – Inform Learners of the Objective

Gagné's second event, inform learners of the objective, states the importance of telling learners what is to be learned prior to the lesson. Knowledge of the learning objectives will create an expectancy that will help a learner to look for and master the information. In the training courses observed, the designers consistently applied this event.

In the Negotiations training, learning objectives were stated by the instructor verbally, just as they might be presented in face-to-face training. In addition, the objectives and key learning points were displayed on billboards throughout the environment. For the DHS and Wargame events, the objectives of the events were

stated in read-ahead materials provided to the participants prior to the course. In general, instructional designers of events with more autonomy or complexity tended to send out read-ahead materials and hold initial briefings to ensure understanding of the environments and the objectives of the interactions.

In the PTSD site, participants enter a visitor's center in which they are encouraged to read pamphlets on PTSD, watch a video offering an overview of the site, listen to audio interviews on PTSD, and view animated dioramas of the site's environment. Learning inside this environment seemed to be deliberately arranged to be less prescriptive and more exploratory in nature. A family member of a servicemember with PTSD, for example, might have a different learning objective than a servicemember suffering from PTSD. Thus, instead of telling learners what their experience in the site should be, visitors must discover what they want to learn with tools built to organize, engage, and guide them in their learning.

In an inquiry-based, exploratory structure, more pressure is placed on the instructional designer to add clear environmental markers into the design so that learners understand and perhaps decide upon personal learning objectives before exploring other parts of the environment.

Event 3 – Stimulate Recall of Prior Learning

Gagné's third event, stimulate recall of prior learning, states that reminding learners of previously learned materials can help them to master new information.

In a facilitated training course, the instructor is able to stimulate recall of prior learning through discussions, questions, and reminders. In the Negotiations course, for example, the instructor associated the negotiations skills to those found in common daily interactions. This training event is held over multiple sessions and the instructor reminded the participants of relevant material from previous sessions through dialog and discussions.

In the PTSD course, involving a trained psychologist in the design details of the environment made it easy to include significant design elements unique to the target audience. For example, in the welcome center, visitors are introduced to the symptoms of PTSD. As visitors travel through the environment, they are introduced to activities that might aggravate these symptoms.

In the DHS course, In the DHS course, trainers are encouraged to understand what type of prior knowledge learners bring to the Virtual Asset Assessment Field

Trip prior to instruction; what background and/or work experiences learners bring to the exercise; how much of the CAPTAP instruction have they completed, etc. Understanding answers to these questions will allow instructions to ask the right questions of learners by referencing information learned prior to touring the virtual facility.

Event 4 – Present the Stimulus

Gagné's fourth event, present the stimulus, states that learners must be presented with a stimulus or introduction of the skill to be learned. If a learner needs to master an intellectual skill, the concept needs to be presented as a rule or problem for the learner to ponder.

The ability to present the stimulus to learn in a creative, engaging, and immersive way is one of the major advantages of 3DVWs. The art of cinematography, creative writing, and the role of architecture can help to deliver a compelling training experience, especially if the elements included in the environment support the learning material. The stories that entice the participants to want to know more, and the active nature of the 3DVWs makes presenting the stimulus extremely engaging.

Careful consideration should be given when weighing the different options available in virtual worlds to training goals. If avatar customization will enhance training, for example, ensuring a virtual world offers this feature should be an important consideration. In the Negotiations training, the virtual world chosen allowed designers to create scenarios to support stories shared. For example, when presenting an example of a baseball player negotiation, the trainees were taken to a replica environment of a well-known ballpark. Similarly, in the orientation lodge of the PTSD site, the virtual world permitted the creation of an animation of a traumatic experience. This allows visitors to visualize this part of the build before experiencing it.

Event 5 – Provide Learning Guidance

Gagné's fifth event, provide learning guidance, also known as semantic encoding states that the stimulus should be as meaningful as possible. Gagné suggested that one way of achieving augmented meaningfulness is by expanding on each idea and relating it to others already in memory.

In 3DVWs, guidance has dual meanings; guiding participants in learning new skills and knowledge, and guiding participants by physically directing them

through the environment. Of the courses observed, the Negotiations and DHS courses followed a fairly traditional method of guiding the participants through the course material. The facilitators provided the information and guided the participants through exercises. In the Wargame, the facilitator provided guidance if participants required redirection or assistance. The asynchronous PTSD environment relied completely on site design and usability testing to provide the guidance, both learning and physical.

It was also apparent that physical guidance to facilitate the movement of the avatars from one point to the next is an important design element in virtual learning environments, and a critical element in un-facilitated learning events. In comparison, the Negotiations environment did not require an abundance of signage and path marking as the instructor was present to gather the participants and instruct them on what to do. However, it was noted that even in an instructor-led training session, where clear verbal guidance was given, some participants could not keep up with the verbal instruction and found themselves lost in another section of the virtual environment. The asynchronous PTSD course, on the other hand, required maps, signage, path markings, and instructions so that participants would understand where they were and how to get where they were going (see Figure 5). In addition to viewing a static tabletop diorama of the site, visitors could play animated dioramas of sections of the environment in advance of visiting it. However, observers noted some participants stopped to view all of the introductory materials before moving on while others raced ahead. It was possible for participants to exit the visitor center without taking full advantage of the explanatory materials.

Figure 5. Screenshot of Dioramas in the PTSD Environment

Check points may ensure the trainees have the materials necessary to fully understand and appreciate all parts of an environment. For example; in some sections of the PTSD environment, avatars are not allowed to fly. This simple technical barrier forces avatars to walk or run, minimizing the chance that they will miss important activities. In a virtual world, multiple communication tools – verbal, visual, technical, and text-based are necessary to provide learning guidance.

Event 6 – Elicit Performance

Gagné's sixth event, elicit performance, states that learners must be able to recall and demonstrate newly learned information in order to truly retain it.

One of the benefits of training conducted in virtual worlds is the experiential aspect. This aspect of virtual worlds can be used to elicit performance if the goal of the training is behavioral, or the performance can give the participants greater insight into the knowledge that is being transferred.

For example, in the Wargame, players on both sides have to understand how new information affects and informs each play of the game. Using the National Operational Environmental Model (NOEM) tool, each team gathers real-time information on specific combat operations choices and incorporates this information into their decision-making process. If they fail to take this information into account or miscalculate the effect of the allocation on the environment, they will not accomplish the goals of the game. Thus, the NOEM tool serves as a vehicle to elicit player performance. In a more traditional approach to eliciting performance, the participants in the Negotiations course practiced their negotiations skills in a role-play scenario.

In virtual worlds, backchat, or texting between members of a group, offers a highly valued form of communication which may be managed to elicit performance and provide feedback. If this functionality is supported in the virtual world, a class-based chat session can be set up which can run in tandem with other group activities. If embraced by the trainer as a valuable form of feedback, tracking and collecting user responses can give the learner an opportunity to demonstrate new skills or mastery of knowledge.

An avatar's shape and form can offer another means of eliciting performance. Research shows that operating an avatar designed to visually resemble the individual can change that individual's real-life perceptions. When subjects watched "twin" avatars exercising and losing weight in a virtual world, their real-world behavior

changed, resulting in healthier eating and exercise habits (Fox & Bailenson, 2009).

Although most of the observed training events did not seem to capitalize on avatar identity research, two role-playing activities in the Negotiations and PTSD training sessions tangentially addressed notions of avatar identity. In both sessions, students were encouraged to dress their avatars in certain types of clothing, to better immerse themselves in a role-play.

Event 7 – Provide Feedback

Gagné's seventh event, provide feedback, states that learners need to be provided with feedback in order to know whether or not they have mastered the information.

Both the PTSD and Wargame environments use gaming techniques as a means of providing feedback. In the PTSD environment, the participants collected points in a heads-up display (HUD) by interacting with programmed objects to reduce PTSD-heightened stress levels. Also, as visitors walk through a mall, interactive objects in the form of trauma-related memories pop up, require interaction and provide feedback. The Wargame used the web-based NOEM tool to provide feedback by graphically demonstrating the reduction in hardship on the populace. Programmable, real-time, virtual objects (like the NOEM tool) which transform and inform avatar actions can add an extremely high level of immersion and feedback to the virtual world environment.

In the Negotiations and DHS training, more traditional approaches were used to provide feedback on performance. Discussion questions were used in the Negotiations training, and in the DHS course, a scavenger hunt for security violations was conducted to assess the trainees knowledge of security procedures. In both courses, feedback was provided verbally by the instructor.

Event 8 – Assess Performance

Gagné's eighth event, assess performance, states that to know whether or not learners have truly mastered the information performance assessments need to take place.

Assessing participants' performance or allowing them to assess their own performance is an important step to applying new skills and knowledge. One of the advantages of 3DVWs is the ability to simulate realistic environments that allow more flexibility for assessing performance.

3DVWs that require the learners to participate in a simulation of realistic scenarios, such as the Wargame and DHS events, lend themselves easily to assessing performance throughout the event. In DHS, the asset manager or trainer can assess performance by noting the type and frequency of questions received. For example, at one point in the tour, an asset manager mentioned that the loss of cell phone service would be an inconvenience, but would not significantly affect the operation of the facility. Asking and understanding why loss of service would not affect the facility would show a trainer that the participant truly understands the task at hand. The DHS training facilitator measures participant performance by noting the number and occurrence of these types of questions.

In both the Wargame and the PTSD environment, a point system allows participants to assess their own decisions throughout the event. In addition, the PTSD build used sensors to know how many unique visitors spent time in different areas.

In a more traditional format, the Negotiations training course offered performance assessment by observing the behaviors and solutions from a negotiations role play.

Event 9 – Enhance Retention and Transfer

Gagné's ninth event, enhance retention and transfer, states that newly learned information can be easily transferred when linked to other concepts and propositions (Gagné and White, 1978).

Based on the nature of simulations and immersive learning strategies, well-designed 3DVW learning experiences should result in better retention and transfer than activities performed in a traditional classroom or webinar setting. Multiple studies have been performed that cite the advantages of serious games and immersive learning simulations (Kapp, 2010) and realistic environments.

In the PTSD site, participants are encouraged to apply and remember learning strategies by installing thought-recording and mood-capturing applications on their cell phones. Maintaining a greater awareness of what triggers anxiety-provoking thoughts can help in combating the illness.

Many of the trainees surveyed regarding the negotiations training commented on the visual

immersion they experienced and how well they recalled information by remembering the environment in which the learning occurred. To further support the application of new skills and knowledge on the job, the Negotiations designers offer a supervisor's coaching toolkit. The additional reinforcement of the new skills by the participant's supervisors ensures greater transfer of the skills to the job.

RECOMMENDATIONS

Taking into account current research in virtual worlds and research on Gagné's Nine Events, observations, and feedback collected for this paper, the following recommendations should be considered when designing learning events for delivery in 3DVWs (see Table 2).

Table 2. Gagné's Events and ISD Recommendations

Gagné's Events	Recommendations for use when designing in 3DVWs
1. Gain Attention	• Keep lecture to a minimum. • Use a story or a challenge to gain participant's attention early in the event. • When possible, make the learner part of the story, not just a spectator. • Match attention-getting stimulus to environment. (e.g., billboards on beach boardwalk) • Make VW and participant interaction meaningful. (e.g., real-world problem solving) • Combine instructional strategies to reach different learning styles. • Offer orientation and rules of conduct. (e.g., how to handle backchat prior to lecture)
2. Inform Learners of the Objective	• Distribute read-ahead material for more complex games and scenarios. • Post rules in accessible location if complex games or point systems are used. • Reiterate learning objectives or goals to participants as objective changes. • Communicate goals to participants consistently. • Ensure visuals suit immersive design structure. (e.g. avoid detailed text on notecards) • Tailor learning objectives to target audiences. (e.g. unique learning paths for each)
3. Stimulate Recall of Prior Learning	• Prescribe learning paths based on prior knowledge. (e.g. special path for novice) • Work knowledge of audience from subject matter experts into site design. • Evaluate learners' skill level prior to bringing them into the 3DVW.
4. Present the Stimulus	• Customize the right avatar for the right learning (e.g., shape avatars as clots in heart) • Weigh features of VWs vs. training objectives. (e.g., avatar customization) • Incorporate machinima or simulation videos as communication strategies. • Draw from VW options to deepen immersion. (e.g. environment, outfits, assets) • Consider a non-linear, learner-directed approach to learning. • Extend 3D environment by combining 2D and 3D elements. (e.g. wiki)
5. Provide Learning Guidance	• Consider assessments that will guide the participants in what they need or want to learn. • Use storytelling to convey the challenge of what participants need to accomplish • Leverage subject matter experts to enlighten or inform participants on relevant topics. • Ensure the physical features of the environment (signage, paths, directions, and instructions) will guide the participants smoothly through the learning experience. • Frequent usability testing, with a range of audiences, is highly recommended to ensure that the learner's experience is actually that which was intended. • Design with the target audience in mind. For example, given the anxiety triggered in those with PTSD, the orientation area is deliberately fashioned to be a relaxing environment using the metaphor of a state park. • Make sure to sufficiently analyze and address technological barriers before deploying; new users need to understand basic navigation and communication within the environment and can easily derail a training session without advance support.
6. Elicit Performance	• Carefully select and test the storylines and scenarios used to elicit performance. • Design events and activities to immerse the learners and convey the meaning behind what you want them to learn. • Encourage backchat as a valuable form of crowdsourcing. • Offer incentives to encourage learners to show mastery of training materials.

	• Ignite crowdsourcing techniques by encouraging co-collaboration.	
7.	Provide Feedback	• Consider using gaming elements and guidelines in the design. • Include HUDs and real-time data for feedback in discovery-based learning. • Program instrumentation feedback or interactivity of objects in the environment.
8.	Assess Performance	• Simulate real-world situations to evaluate learning. • Use gaming techniques or point systems to reinforce correct skills and behaviors . • Use multi-collision sensors to track avatar identity and time spent in build. • Consider role plays to assess knowledge. • Monitor backchat for questions or clarification needed.
9.	Enhance Retention and Transfer	• Build with the end in mind.(e.g. check if stories/scenarios scaffold to desired tasks) • Set up reasons to return to the build (e.g., weekly themes or follow-up events). • Offer takeaways to use when applying new skills to the job. • Provide follow-up activities or coaching to ensure that new skills are applied properly.

SUMMARY

3D Virtual Worlds offer new and exciting opportunities for instruction. As ISDs expand their horizons and learn to leverage this new modality as a learning environment, they need to ensure that the established principles of instructional design are applied to these training courses. Although the scope of the research for this paper was limited, it lends credence to the fact that Gagné's Nine Events of Instruction can and should be applied to training courses designed for 3DVWs.

ACKNOWLEDGEMENTS

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