Assignment 3: Research Possible Solutions

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Introduction

IVR in the classroom offers educators transformative resources for improving teaching and learning. IVR applications must have clear pedagogical affordances that facilitate faculty development and compatible curricular options.

Currently, learners within K-12 curriculum are *digital natives* who thrive on sharing and experiencing new perspectives of education. According to Hu-Au & Lee (2017), the educational sector has been affected by a shift from *Information Age* to the current *Experience Age,* and IVR applications are becoming effective tools for providing learners with engaging experiences. IVR learning environments are explorative, practical, motivating, and visually rich. Moreover, in these student-centered environments, learners can gain critical thinking and collaborative skills that are essential in the *Experience Age.*

IVR tools are evolving, and new applications are emerging daily. Educators must leverage functionality, accessibility, privacy, and pedagogical affordances of these emerging IVR applications for effective integration in classrooms (Ardoin, Bowers, Roth, & Holthuis, 2018). IVR in education is a recent phenomenon, and educators face challenges evaluating, selecting, adopting tools that align to a specific curriculum, and support student's learning experiences.

This paper reports on affordances of IVR tools that are critical for teaching and learning in K-12 curriculum. In this paper, *affordances* refer to fundamental and actual properties of IVR tools that determine how they can be put to use for education. Teachers need to make informed decisions in selecting tools that work and, in this case, provide students with relevant learning experiences.

Affordances of Immersive Virtual Reality Tools

Immersive virtual reality in its nature supports experiential learning, through hands-on activities that involve observation, visualization, active conceptualization, and

experimentation within simulated virtual spaces. IVR tools aligned to experiential learning model provide users with engaging real-world experiences enabling learners to retain memories of the interaction even after returning to non-virtual settings. The leading tech firms – Google, Facebook, and Microsoft – have made substantial investments in virtual reality systems that are affordable, accessible, and functional (Jowallah, Bennett & Bastedo, 2018). Moreover, prevalence of smartphones has also contributed to the emergence of virtual reality systems that facilitate low-cost experiences.

For educators today, all that is required to create a virtual reality experience is a smartphone, a virtual reality headset, and headphones if there is need for sound. These low-cost experiences have limited capacity, though they impact positively on users when applied to augment teaching and learning. Moreover, they require minimal technical support and are readily compatible with most mobile operating systems (Minocha, Tudor & Tilling, 2017).

Transformative IVR systems have emerged that allow movement within space, and users physically walk around while navigating the virtual space creating a comprehensive, immersive experience. These enhanced virtual experiences enable users to connect to real-world situations, participate in a multi-sensory learning experience, improve cognitive skills, and critically explore issues of social and environmental justice (Markowitz, Laha, Perone, Pea, & Bailenson, 2018). IVR tools for education are now ubiquitous, and K-12 educators are exploring teaching opportunities for their select curriculum.

Categories of Affordances for IVR Educational Tools

Educational researchers are yet to fully define categories for IVR educational tools. Johnston et al. (2017) research identified and categorized principles and practices of pedagogy in select virtual reality educational applications and found that majority delivered experiential learning experiences. Johnson-Glenberg (2018) explored embodied design principles of VR educational applications with a positive impact on academic outcomes.

According to Johnson-Glenberg (2018), two profound affordances that can significantly contribute to educational outcomes are; *feeling of presence* and *embodied gestures with capacity to manipulate content in 3-D.* Kaminska et al. (2019) paper provided insight on VR applications in education and recognized their capacity for cross-curricular learning, largely through use of Head Mounted Devices that provide 3-D immersive experiences of real-world situations.

Jowallah et al. (2018) report on leveraging affordances of VR applications in K-12 curriculum acknowledges need for scalable systems for ease of adoption as virtual reality is bound to transform education in the future. Minocha, Tudor & Tilling (2017) exploratory study focuses on technological affordances of Google Expeditions in providing users with experiential learning models through virtual field trips, experiences that improve on academic outcomes.

This paper attempts to expound on affordances of IVR for education by delving in existing literature on the subject, developing a rubric framework, and listing categories aligned with experiential learning models. The framework serves as a guide on how best to implement IVR in the classroom.

Feeling of Presence

IVR tools systematically sustain an illusion of presence; users feel they are part of the virtual space. According to Johnson-Glenberg (2018), *presence* is the first profound affordance of virtual reality experience. The ideal IVR educational tool must fully engage users within a heightened emotional space and to positively impact on learning.

Embodied Gesture and Control

The ability to control and manipulate objects within virtual spaces is the second profound affordance (Johnson-Glenberg, 2018). Gesture within the VR environment involves

communication and action for manipulating objects, affordances that are important for hands-on learning experiences.

360-degree Visual Authenticity and Navigation

IVR educational tools ought to provide users with an explicit physical representation of the environment, spatial relations, that includes an all-round, wide view. This affordance enhances a sense of spatial presence, interactions, and immersive experiences void of any external distractions. 360-degree navigation enables users to navigate and orient themselves within the virtual spaces (Minocha et al., 2017).

3-D View

This affordance allows users to visualize real-world representations of simulations and simplifies understanding of perspectives. This affordance also encompasses visualization and offers users a sense of place.

Teaching Presence

The role of instructor in virtual spaces should be similar to that of physical spaces, act as facilitators, customize experiences, and receive feedback. An effective IVR tool must have affordances that grant instructors control of virtual spaces for effective curriculum implementation.

First-person Perspective

Aligning IVR tools to experiential learning theory requires students to be actively involved in the learning process. This affordance offers users a first-person point of view, enabling them to be active participants within the virtual environments.

In-situ Contextual Information

Experiential learning occurs through realistic experiences and abstract conceptualization. This affordance provides instructors with ability to project text-based interventions within an interactive virtual environment.

Simulations

IVR experiences are based on real-world simulations of concepts, places, events, and processes. Simulations must be realistic, detailed, and the user must also be able to connect all elements within the simulated virtual environment.

Single-user Handling

The essence of experiential learning is to enable students to make connections between new concepts and existing ones. Single-user handling affordance allows students the independence for self-guided explorations, arousing their curiosity and understand concepts through their own perspectives. This affordance offers learners the flexibility to explore what they want, remain focused, and without distraction from peers.

Cross-curricular Teaching and Learning

IVR tools offer educators the opportunity to apply multiple academic disciplines simultaneously. This affordance allows students to experience several concepts of the real-world through a single lens, further increasing engagement and collaboration with peers in distant places.

Rubric for Affordances of IVR Tools for Education

The rubric below acts as a guide for teachers on evaluating and identifying an appropriate IVR tool that is aligned to their course design and facilitates meaningful learning experiences.

Category	**Works Well**	**Minor Concerns**	**Serious Concerns**	**Not Applicable**
Feeling of Presence	Tool provides user with a sensation of Location	Tool provides users with 2-D experiences	2-D and 3-D experiences are lacking	
Embodied Gesture and Control	Tool has hand-held controls		Uses HMD with no	

		Only uses HMD for Manipulation	manipulation features	
360-degree Visual Authenticity and Navigation	Explicit physical representation of space; spatial relationships, sense of spatial presence, and experienced immersion.	Tool has limited capacity for explicit spatial representation	Tool fails to meet user immersive expectations	
3-D View	Supports realistic simulations of physical objects	Simulations are entirely in 2-D	Tool totally lacks capacity for dimensional views	
Teaching Presence	Tool has easy-to-use features that greatly compliments instructor ability to be present with learners via active observation, engagement, and feedback	Tool has limited functionality to support an instructor ability to guide and intervene	Tool not designed to support instructor presence	
First-person Perspective	Tool offers users sense of presence. User assumes role within Environment	Tool offers user sense of presence without a first-person perspective	Tool lacks capacity for first-person perspective	
In-situ Contextual Perspective	Tool enables educators to plan lessons, develop learning	Tool has limited aspects that can be customized for context and learning outcomes	Tools entirely lacks contextual perspective	

	activities, and evaluate performance			
Simulations	Tool delivers realistic images and users Connected to elements of simulation	Tool lacks simulation features and only operates in 2-D	Tool lacks capacity to view 3-D simulations	
Single-user Handling	Tool offers users individual viewing experiences, flexible for self-guiding, opportunity for exploration.	Tool is single-user though lacks presence or gesture capabilities	Tool can only be used by one or more users	
Cross-curricular Teaching and Learning	Tool is adaptable to its environment, customizable to suit context and target learning needs	Tool developed for a specific subject and cannot accommodate multiple subjects	Tool lacks features that can facilitate cross-curricula learning	

Conclusion

IVR in classrooms offers students practically oriented learning content that is different from the traditional approach that focuses on memorizing facts. Additionally, the traditional classroom fails to deliver on the changing needs of modern students who are essentially digital natives. Educators need to identify IVR affordances that are aligned to pedagogical expectations of specific course design and equally support student learning needs (Jowallah, 2018). There is a dearth of literature examining affordances of IVR for education, and this report lays a foundation for research on the subject. Educators need a framework on how best to adopt IVR tools for classrooms.

References

Ardoin, M. N., Bowers, W. A., Roth, W. N., & Holthuis, N. (2018). Environmental Education and K-12 student Outcomes: A Review and Analysis of Research. Retrieved from https://doi.org/10.1080/00958964.2017.1366155

Hu-Au, E., & Lee, J. (2017). Virtual reality in education: a tool for learning in the experience age. Retrieved from https://www.researchgate.net/publication/324704089_Virtual_reality_in_education_a_tool_for_learning_in_the_experience_age

Johnston, E., Olivas, G., Steele, P., Smith, C., & Bailey, L. (2018). Exploring Pedagogical Foundations of Existing Virtual Reality Educational Applications: A Content Analysis Study. Journal of Educational Technology Systems, 46(4), 414–439. https://doi.org/10.1177/0047239517745560

Jowallah, R., Bennett, L., & Bastedo, K. (2018). Leveraging the Affordances of Virtual Reality Systems Within K–12 Education. Retrieved from https://nsuworks.nova.edu/fdla journal/vol3/iss1/7/

Kaminska, D., Sapinski, T., Wiak, S., Tikk, T., Haamer, E. R., Avots, E., Helmi, A., Ozcinar, C., & Anbarjafari, G. (2019). Virtual Reality and Its Applications in Education: Survey. Retrieved from https://www.mdpi.com/2078-2489/10/10/318/htm

Markowitz, D. M, Laha R., Perone, B. P., Pea, R. D. & Bailenson, J. N. (2018). Immersive Virtual Reality Field Trips Facilitate Learning About Climate Change. Retrieved from doi: 10.3389/fpsyg.2018.02364

Minocha, S., Tudor, A., & Tilling, S. (2017). Affordances of Mobile Virtual Reality and their Role in Learning and Teaching. Retrieved from https://dl.acm.org/doi/10.14236/ewic/HCI2017.44