Assignment 1

Tonishee Smith
tsmith384@gatech.edu

1 RESEARCH LOG

1.1 Background

Though I do not have any concrete ideas for my research project, I do find myself interested in educational technology as it relates to using emerging technologies to facilitate learning. There was an internship I had that provided the opportunity to work closely with augmented reality tools to create an augmented reality glossary for the telecommunications company I worked for. In this manner, I was able to get my first experience on how simulation can be used for training and that influenced me to look at resources focused on simulation based learning and more constructivist learning theory. In addition, I have familial ties to both the educational and medical space so there is curiosity in that realm as it pertains to learning and instruction and the best way in which those spaces can utilize these "other" technologies for enhanced learning experiences.

1.2 Papers

1. Wilensky, U., & Resnik, M. (1999). Thinking in Levels: A Dynamic Systems Approach to Making Sense of the World. Journal of Science Education and Technology, 8(1), 3-19. https://doi.org/10.1023/A:1009421303064

- This paper was provided under the "Getting Started with Simulation Based Learning" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** The authors advocate for reimagining scientific learning through the perspective of levels, or descriptions of systems and their parts. They conduct and analyze case studies of teachers and students who explore this "level" thinking to support their initial claim. The results of their case studies perpetuate that level thinking is essential to fundamental learning and computational instruments can facilitate it.
- **Takeaways:** My understanding of this paper is that thinking or learning in terms of "levels" simply means understanding the root to understand the entirety of the system. Knowing what level a particular topic is taught

at, lends itself to more appropriate representations and analogies that can be disseminated. This could facilitate a more confident and accurate digestion of learning material.

2. Bradford S. Bell, Adam M. Kanar & Steve W.J. Kozlowski (2008) Current issues and future directions in simulation-based training in North America, The International Journal of Human Resource Management, 19:8, 1416-1434, DOI: 10.1080/09585190802200173

- This paper was provided under the "Getting Started with Simulation Based Learning" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** This article focused on the idea that trainees should be engaged and active in their own learning for anything meaningful to be derived from the instruction. It pushed the notion that simulation should be a fundamental part of the process for organizations and through discussion identified various needs for simulation based learning in industry training.
- **Takeaways:** There are both positives and negatives to simulation based training. On the positive- individuals are engaged, it provides a medium for real events and tangible learning at a convenience often not afforded. On the negative- creating simulations are often expensive both in cost and in development and may not be feasible for every organization.

3. SSIH (n.d.). About Simulation. Society for Simulation in Healthcare. Retrieved August 26, 2023, from https://www.ssih.org/About-SSH/About-Simulation

- This resource was provided under the "Getting Started with Simulation Based Learning" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** This site describes simulation as "the representation of one act or system by another" (SSIH) . There is a specific focus of simulation within the healthcare space and the four purposes it serves- education, assessment, research, and heath system integration. With this description, is a callout to the idea that simulation allows for low stakes training for an otherwise high risk environment.
- **Takeaways:** With this resource, there was an introduction of framing simulation based training in the healthcare space. In framing it in an

intense domain, advantages like the freedom to learn and the ability for learning to be tailored to participants was made more apparent. The detail for which simulations are created can make gaining knowledge and skills replicative of a real-world experience without the high cost and risk of training in the medical field.

4. Al-Elq, A. H. (2010). Simulation-based medical teaching and learning. Journal of family and Community Medicine, 17(1), 35.

- This was found via Google Scholar in search of simulation based learning.
- **Summary:** This literature contends that "deliberate" practice is a more effective learning style than apprenticeship, where apprenticeship refers to the in-person, real patients real cases method of training new physicians that is often employed in the medical field (Al-Elq, 2010). The article aims to emphasize the instructional and learned gains of simulation based medical training at various levels of education. Though, there is further research to be done to correlate training styles with patient outcomes.
- **Takeaways:** Much like other literature pertaining to simulation based training in the medical field, this article highlights the advantages of having practical, replicated training for medical professionals. The notion of a low stakes learning for a high risk profession is framed as allowing space for failure and feedback which may not be available in a typical apprenticeship.

5. Lateef, F. (2010). Simulation-based learning: Just like the real thing. Journal of Emergencies, Trauma and Shock, 3(4), 348.

- This paper was provided under the "Getting Started with Simulation Based Learning" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** This article defines simulation as a "technique" (rather than a technology) for learning that models real experiences with guidance and situational immersion (Lateef, 2010). The motivation of this article is to assert that simulation based training can and should be added to traditional instruction. It concludes with speculation that this type of learning may have positive ramifications for the perceptions of health related fields to patients.

- **Takeaways:** It was a different perspective in viewing simulation not just as a technology- like using a virtual reality headset to view a to-scale model of the human muscle mass- but as a technique. This framing introduces a level of intentionality that may get overlooked by the otherwise complex and more "cool" aspects of simulation based learning. This intentionality works to see possible ways in which there are less tangible effects to this learning style, like possible improvement of perceived good ethics and physician confidence.

6. Lathrop, A., Winningham, B., & VandeVusse, L. (2007). Simulation-based learning for midwives: background and pilot implementation. Journal of Midwifery & Women's Health, 52(5), 492-498.

- This paper was found at ScienceDirect via Google Scholar.
- **Summary:** This article provided a perspective of simulation based learning as it pertains to midwifery and the three domains of performance that should be supported through training. Those include cognitive, psychomotor and affective performance. The authors pay special attention to the last domain, remarking that the ability to navigate a crisis, and the facets associated with it, is important for the practice of midwifery. Traditional, non-simulation based training often does not provide enough instruction or support for students to improve affective performance.
- **Takeaways:** This article introduced me to the idea of affective performance, which is understood to be crisis management by another name. In drawing connections between the aviation industry which heavily uses simulations as a training method, it is better understood the role of simulations allows for other practical skills to foster and improve that wouldn't otherwise get attention through passive methods.

7. Swaak, J., Van Joolingen, W. R., & De Jong, T. (1998). Supporting simulation-based learning; the effects of model progression and assignments on definitional and intuitive knowledge. Learning and instruction, 8(3), 235-252.

- This paper was found at ScienceDirect via Google Scholar.
- **Summary:** This is a study where participants engaged with a simulation that featured both model progression, or the incrementation of complexity in the sim, and assignment, or exercises conducted in the sim.

This study was presented in three modes, where both, neither or only model progression was used by participants. The results indicated that utilization of model progression and/or assignment positively influenced intuitive knowledge.

- **Takeaways:** The effects of learning from simulations, in this case computer based simulations, may not be easily described or measured. By exposing people to simulated environments that contain a lot of information, it is often not clear how those individuals will retain that information. Causal information may be learned, such as "Action X causes result Y", but individuals may not be cognizant of the *why* or *how*.

8. Blecha, B., McBride, M., Riley, T., Rowell, K., McGoldrick, K., Maier, M., & Simkins, S. (2018, May 7). Teaching with Simulations. Pedagogy in Action: the SERC portal for Educators. https://serc.carleton.edu/sp/library/simulations/index.html

- This was provided under the "Getting Started with Simulation Based Learning" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** Instructional simulation is when students model the behavior of a particular event, situation or topic to improve overall comprehension of behavior or topic modeled. The idea here is that active engagement fosters knowledge transfer and appropriate application.
- **Takeaways:** In order for instructional simulation, or any type of simulation, to work there must be a level of interest shown by the participants, preparation and time to review and assess knowledge retention and understanding. In addition, this source alluded to the transfer of knowledge which made me connect possible effects of simulation based learning to an improved use of case-based reasoning mental models to apply learned information.

9. Watson, W. & Watson, S. (2007) An argument for clarity: what are learning management systems, what are they not, and what should they become. TechTrends, 51(2), pp.28-34. hal-00692067f

- This was provided under the "Getting Started with Learning Management Systems" section of the CS 6460 Educational Technology Research Guide.

- **Summary:** This article starts by defining what a learning management system is, calling out related but not equal terms like learning content management systems and course management systems to bolster a clearer definition of LMS. In this article, there is a push to adapt to changing, more technological education spaces with tooling to support it.
- **Takeaways:** Learning management system's primary focus is to manage *how* things are learned, not necessarily the content that is created. It is a process focused system that can be used to create and support highly effective learning environments.

10. Boticario, J. G., & Santos, O. C. (2007). An Open IMS-based user modelling approach for developing adaptive learning management systems. Journal of Interactive Media in Education.

- This was provided under the "Getting Started with Learning Management Systems" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** Researchers attempt to address the issues of adaptive learning management systems with their current research. Their research attempts to rectify the depersonalization that is prevalent in learning management systems especially with regards to accessibility.
- **Takeaways:** Learning, or perhaps more accurately learning instructruction, is often characterized in a one-size fits all approach that has been proven over time not to be effective for all people who consume knowledge. In the same manner, adaptive LMS looks for ways in which there can be an element of "customization" to an LMS. This type of flexibility installed into the system, as articulated by the researchers' results, works positively towards a learner's success.

11. Mindflash (n.d.). LCMS and LMS. Trakstar Learn. Retrieved September 1, 2023, from https://learn.trakstar.com/blog/lms-and-lcms

- This was provided under the "Getting Started with Simulation Based Learning" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** This resource provides definitions for both learning management systems as well as learning content systems. LMS is defined as the actual tool "managing the experience of students" (Mindflash) when they engage with online learning content. Conversely, LCMS is

more concerned with assisting with content creation for online learning programs.

- **Takeaways:** Largely, this resource provided clear definitions for LMS and LCMS which aided in the understanding of other LMS resources consulted for this research log. LMS is participant experience focused- how can this tool best serve the learning needs of those who use it. Whereas LCMS is content focused- as in how can this tool allow for the generation of effective and knowledgeable content.

12. Suhendi, A. (2018). Constructivist learning theory: The contribution to foreign language learning and teaching. KnE Social Sciences, 87-95.

- This was found at KnowledgeE via Google Scholar search for constructivist learning.
- **Summary:** This article focused on the subdomain of constructivism and analyzed the way this learning methodology can be used in typical instruction and exercises. The results indicate that there is a positive impact of constructivism on the overall education progression because of the inherent piqued interest of the students involved in this style of learning.
- **Takeaways:** For education and knowledge to be meaningful there should be this "buy-in" into the learning process which constructivist learning theory, as expressed by the authors, supports. This idea of creating their own knowledge also likens to the idea of fostering one's ability to apply transferred knowledge, which is rooted in deep understanding of a learned topic or behavior.

13. Mattar, J. (2018). Constructivism and connectivism in education technology: Active, situated, authentic, experiential, and anchored learning. RIED. Revista Iberoamericana de Educación a Distancia.

- This was found via Google Scholar search for constructivist learning.
- **Summary:** This article features an analysis and categorization of constructivism and constructivist related disciplines and how they can be applied to distanced learning tools. The author poses constructivism more as a broad philosophy with subsets like situated cognition and experimental learning. The results of this analysis specifically attempts to

position connectivism as a learning theory for digital spaces versus constructivism.

- **Takeaways:** My main takeaways from this dissection of constructivism is that it is a much more generalized theory characterizing the notion of building one's knowledge base. There are more specific domains and theories with which focus on a particular method of constructing and linking learned knowledge to real applications. I also found it interesting in the section for further work that the author notes AR and VR technologies as needing more targeted studies to assess their influence in education technology in an increasingly digital age.

14. Bruckman, A. (1999, March). Can educational be fun. In Game developers conference (Vol. 99, pp. 75-79).

- This was provided under the "Getting Started with Constructionism" section of the CS 6460 Educational Technology Research Guide.
- **Summary:** A wonderfully worded critique about the shortcomings of games and their balance of educational and fun. Bruckman contends that oftentimes educational games are unnecessarily made upbeat, happy and/or visually loud in lieu of actually introducing engaging elements to them. A bulleted list of dos and don'ts is ultimately provided as guidance to keeping games both fun and educational.
- **Takeaways:** Gaming structure can help to produce an organic element of fun in educational games. For example, designing games with open ended tasks fosters critical, creative thinking which may tap into feelings of fun for users. Or situating game scenarios is applicable and appropriate context also can allow for fun to be maintained.

15. Papavlasopoulou, S., Giannakos, M. N., & Jaccheri, L. (2019). Exploring children's learning experience in constructionism-based coding activities through design-based research. Computers in Human Behavior, 99, 415-427.

- This was found via Google Scholar.
- **Summary:** The study reported in this article aims to analyze how computational tools and coding platforms like Scratch are inherently based in constructionism through a design based research approach. Some key findings from this study are that in order for value to be taken from constructionism frameworks like many computer science related

learning tools students need to exhibit a certain level of engagement and correct appropriation of design, tasks, and time must be used.

- **Takeaways:** For the most part, I have often thought of computer science and coding a puzzle. But this paper puts it in perspective that programming is an active building of both one's skill and one's knowledge- in reference to both the material coded for and the coding itself. It is understood that constructionism (and tools that follow this theory) usurps the *learning* cognitive load with the *doing* cognitive load, which based on this resource and others fosters retention and understanding of information.

1.3 Synthesis

My research efforts are still ongoing but this current body of work highlights interesting trends and connections between constructionism, simulation based learning, and learning management systems.

From the simulation based learning perspective, it is apparent in the literature that having access to an immersive and interactive tool to support learning of a particular topic or domain not only reinforces the underlying material that it is supposed to cover, but it also provides this "other", less tangible incentive regarding trainee or student ability to navigate a situation. This was best articulated by Lathrop et al. with the idea of affective performance, which directly assesses one's ability to make order of a crisis situation (2007). Al-Elq and Lateef connect simulation based medical training to that of aviation training, which often uses simulated as a technique for instruction. This emphasizes the positive tradeoff of being able to navigate an otherwise high risk situation in a lower risk, more failure sensitive environment (Al-Elq, 2010 & Lateef, 2010).

The underlying theme in the sources for constructionism articulate this notion of participant buyin, one's control over being able to build their own knowledge (Suhendi, 2018). Thinking about this in conjunction with the ideas presented for simulation based learning makes it more apparent why simulation based learning is often seen as effective. In these situations, individuals are given virtual or hypothetical tools, but they must engage with the simulation and *build* or *construct* their own responses and their ability to do so, to perform, in these simulations is a testament to their overall comprehension.

1.4 Reflection

In past studies, I have engaged with scholarly sources in depth through literature review, but with that came an affordance of time and space to dive deep (or deeper) into the content. I think for this process it felt overwhelming at times, even when employing the techniques described in "How to Read an Academic Paper" on the CS 6460 Research Guide because there was uncertainty in the relevance of material when only digesting parts of it. In addition, what was especially difficult was understanding my own takeaways versus a reiteration of material found. What made this process easier was trying to understand what was presented by these sources and how they could possibly relate to topics that I already had knowledge about. Going forward, I am definitely interested in getting more information about simulation based learning with respect to other domains other than the medically related ones discussed in the log.

1.5 Planning

Next week, I aim to focus my research in simulation based learning and perhaps look a bit outside of that realm with respect to application of augmented and virtual reality in the educational space. I also plan to amass this literature earlier in the week to allow for more time for information digestion. As far as question are concerned, my hope is that the literature can answer the following questions:

- *What other domains and industries can use simulation based learning and how can it be applied?*
- *How can emerging technologies aid in simulation based learning*?
- *In what ways can technologies like augmented and virtual reality elevate traditional educational spaces like academics?*

Though these questions are admittedly broad, I hope to gain a more targeted perspective after reviewing the literature for this coming week.

2 ACTIVITY

1. Lathrop, A., Winningham, B., & VandeVusse, L. (2007). Simulation-based learning for midwives: background and pilot implementation. Journal of Midwifery & Women's Health, 52(5), 492-498.

Need- The need articulated here is for an innovative way to teach real clinical scenarios, whether they be standard care or emergency situations. This need

arises out of facilitating midwives with the clinical and response skills required to perform their function.

Method- Lathrop, et al. implemented a "simulation-based shoulder dystocia learning module" (Lathrop et al., 2007) for participants to self-assess their readiness to manage this clinical situation.

Audience- The audience for the information and value articulated in this paper more align with instructors of midwifery, though the module used in assessment targeted novices to midwifery, particularly those in their second year of nurse-midwifery education.

Results- The primary method for results finding was through evaluation and feedback of the participants. The authors report that students' response toward simulated based education was positive. Self assessment scores pertaining to areas of psychomotor, role attainment, and cognition were gathered from participants pre and post simulation. Reported psychomotor assessments averaged from 2.5 (pre) to 4.25 (post), role attainment 2.0 (pre) and 4.25 (post), and cognition 3.75 (pre) to 4.25 (post) (Lathrop et al., 2007).

Critique- Though results indicate positive trend, subjective method for calculation (self-assessment) and the small sample size for experimentation (four students) introduces a level of scrutiny over the author's initial assertion that simulation based training can be highly effective towards skills in the cognitive, psychomotive, and crisis management space. Conversely, it is the positive feedback that supports inclusion of simulation based instruction as it indicates a level of interest and engagement that would work towards its effectiveness as a tool. For their argument to better support their specified need, the authors sample size would need to be larger with a measurable more quantitative and objective measurement for assessment.

2. Swaak, J., Van Joolingen, W. R., & De Jong, T. (1998). Supporting simulation-based learning; the effects of model progression and assignments on definitional and intuitive knowledge. Learning and instruction, 8(3), 235-252.

Need- The authors assert that there is a need for more methods of instruction that would result in more intuitive gathering knowledge, albeit a form of knowledge that is not always articulated in definite and tangible ways.

Method- This study is designed to use System for Exploratory Teaching a Conceptual Model of Oscillatory Motion (SETCOM) in combination with incremental complexity and exercises to derive knowledgeable gain in two domains: definitional (concrete) and intuitive (Swaak et al., 1998). They measured student "intuitive" knowledge gain through a test that assessed student ability to infer relationships presented in the simulation under a time constraint. They emphasize in their assessment that verbalizing their comprehension is not relevant to the results or success of the test.

Audience- For this study, 63 first year physics students with "recent completion of an introductory course on dynamics" participated in the study (Swaak et al., 1998). The findings of this paper is geared towards professors in fields where course material is rich in information but also highly applicable, like physics or engineering.

Results- The study performed and compared results of three post experiment tests: definitional knowledge test, intuitive knowledge test, and propositional knowledge test. With respect to intuitive knowledge versus definitional knowledge gained, the results indicate that correlation was 0.06 which to their deviations mean that a gain in intuitive knowledge did not equate to a definitional gain (Swaak et al., 1998). Overall, both conditions of the experiment (complexity and exercise) fosters gains in intuitive knowledge.

Critique- With a considerable sample size and quantitative analysis, this study appears to support its need that simulation fosters intuitive knowledge retention, though only marginally where comparisons with other knowledge schools are taken into account. However, it is important to note that the authors remarked that participants could engage in multiple runs, which could skew data for or against their initial assertion.

3. Mattar, J. (2018). Constructivism and connectivism in education technology: Active, situated, authentic, experiential, and anchored learning. RIED. Revista Iberoamericana de Educación a Distancia.

Need- Mattar theorizes that a connectivist, rather than merely a constructivist approach to digital education spaces can be used to improve the overall effectiveness and engagement of them.

Method- A breakdown of constructivism and investigation of the various subdomains are used as application for online learning environments and tools like MOOCs. The author performs a targeted literature review in which "extraction focuses on the relationship of constructivism, educational technology and distance education" (Mattar, 2018).

Audience- The audience for this review are instructors of online learning space or distanced education.

Results- Constructivism is broken down into the theories of situated cognition, active, anchored, experimental and authentic learning, with connectivism being identified and categorized as its own theory with links to constructivism. The deferring factor that led to this separation is that there is an equating connectivism with distributed cognition which is highly prevalent in online learning environments.

Critique- The author remarks that it is important for learning in distant classrooms to be active, emphasize language as a tool, and be student focused. Ultimately, their review indicated that there is not enough concrete experimentation to attest to framing connectivism as pedagogy for online, educational spaces. Though the literature review can derive common themes and theories, there wasn't direct application of the findings to an in progress experiment or study. Only speculation with regards to formats such as MOOCs and other tools. The author even notes that further work is required for a more assertive stance to be taken on the connectivist versus constructivist standpoint.

4. Wilensky, U., & Resnik, M. (1999). Thinking in Levels: A Dynamic Systems Approach to Making Sense of the World. Journal of Science Education and Technology, 8(1), 3-19. https://doi.org/10.1023/A:1009421303064

Need- The author argues that science should be taught from the perspective of levels. In this context levels are considered to be part-whole composition where the part influences the whole and is often dynamic, contributing to the broader complexity of the whole system.

Method- Authors implemented a modeling language for students to use to "build models of multi-leveled phenomena and through these constructions explore the concept of level" (Wilensky et al., 1999).

Audience- This study was published in the Journal of Science Education and Technology. Targeted audience seeks innovation of practice in the science space for instruction and/or learning. Participants using the StarLogo language model to explore levels ranged from students to teachers in Boston public schools.

Results- The study reported the exploration of levels by referencing three case studies in detail. The authors report that students were able to gain a better understanding of scientific levels or systems through the use of computational modeling and simulation, afforded by the StarLogo language model.

Critique- In reading through the case study, while certain derivations were taken in assessment of the understanding of levels, largely the results are substantial and qualitative in nature. Though this does not reduce the validity of the experimentation, this would have been a great candidate for additive data that better articulated the comprehension of scientific levels through simulation from the larger sample pool. Conversely, the detail with which each case is presented provides support towards the need and the idea that level prompts students to dive deeper into scientific concepts.

5. Papavlasopoulou, S., Giannakos, M. N., & Jaccheri, L. (2019). Exploring children's learning experience in constructionism-based coding activities through design-based research. Computers in Human Behavior, 99, 415-427.

Need- The need articulated in the experimentation is that constructionism provides educational value in computer science and programming tasks.

Method- Authors conducted a four staged design based research task that included 1) a literature review 2) identification and design of experiment based on literature review 3) testing and iteration of the theoretical framework and 4) analyzing results to identify design principles.

Audience- Each stage of the research task had different target audiences and participants. For instance stage 1, 2, and 4 drew largely from HCI and TEL experts and researchers. Stage 3 featured three iterations where children with ages ranging from 8-17 were subjects. The study was published in the Computers in Human Behavior which speaks to a broader HCI focused expert audience.

Results- The experiment deduced various theoretical ideas from the observed behaviors during experimentation. Among them are the idea of learning for the sake of learning, the significance of “cognitive effort”, “affective engagement”,

and social interaction during construction or coding, metacognitive thinking and its applications with regards to students' coding activities (Papavlasopoulou et al., 2019).

Critique- The study supports its need through its comprehensive design, using a literature review to inform the design and motivation for supplemental experimentation featuring a large sampling pool. In addition, the iterative nature of the experiment stage allowed for a logical progression and influence of derived concepts, which aided in the resulting theoretical formations. However, while the over sample size was large it was not equal. Iteration 1 featured 44 participants, mixed gendered. Iteration 2 featured 105, also mixed gendered. While iteration 3 only features 8 girls in testing. The conclusions drawn from iteration 3 may have large participation bias which may skew derivations specifically sourcing the third cycle as evidence.