Assignment 1:
CS6460: Education Technology

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1. BACKGROUND

Currently I am less clear on the problem I want to try to solve and more clear on the technologies I want to use to solve the problem. This intuitively seems backwards. With that being said here is a list of potential technologies I have a passion for learn and using for this project:

- Swift (Server Side)
- Kubernetes
- Istio
- Kafka
- Event-Driven Architectures
- Machine Learning

Some early idea I had was around custom learning plans that place the learner at the center of the learning process. Allowing the learning processes to be more self-driven. This might include, reconditions on which chapter of a book to read based on the Learners strengths & weakness. Nothing has really jumped out as "the idea". What is clear is I want to make some sort of tool, perhaps something a teacher could use to make the learning process more Learner centric. In my experience I learn best when allowed to explore and ask questions rather than be told how something works. So an early thought is to build something that enabled this learning process. Also, possible extensions to existing Learning Management Systems is also being considered.

2. PAPERS

2.1 Paper

Papert, S. (n.d.). Children, Computers, and Powerful Ideas. 11.

2.1 Found Via

Research Guide, under the constructionism topic.

2.1 Summary

Learner is put in the center of the learning process by having the learner teach the computer what to do, and how to do it. Transition the learning process from one of ingesting knowledge from a source i.e teacher, instructor, and Sesame Street and into a self-directed, active experience. In this learning style, you learn with less a curriculum and more in a self-guided way.

2.1 Take Aways

Instead of treating the computer as an information displayer, or ingested in to form of reports and electronic tests. Use the computer as an extension of the Learners tools and though processes. By learning to teach a computer how to draw a house, you learn concepts in math like geometry. Let the Learner go where they want using the computer as an extension of thought and execution.

2.2 Paper

Koedinger, K. R., Brunskill, E., Baker, R. S. J. d, McLaughlin, E. A., & Stamper, J. (2013). New Potentials for Data-Driven Intelligent Tutoring System Development and Optimization. *AI Magazine*, *34*(3), 27–41. https://doi.org/10.1609/aimag.v34i3.2484

2.2 Found Via

Google search: "Intelligent Tutoring Systems"

2.2 Summary

There exists the "Data Shop", with over 350 open source dataset around student actions this could be used to build/re-create Intelligent Tutors. Intelligent Tutor assists student as the Learner progresses through the curriculum (outer loop) as well as with a lesson (inner loop). Previous work has been done using a rule-based system (SimStudent) as well as models who's representation of the world is of the form of knowledge components which it can use to probabilistically assign an estimate of the learners understanding. While other approaches use MDP's (Markov Decision Processes) and Reinforcement Learning techniques (Hint Factory)

2.2 Take Aways

There appears to be a lot of different approaches to creating Intelligent Tutor Systems. At the core of them is this inner and outer loop where the systems attempt to understand and assist the Learner in the learning processes. The "Data Shop" could be used to provide the required data to train such an intelligent system. The RL approach (Hint Factory) is something I am really interested in.

2.3 Paper

VanLehn, K. (n.d.). The Behavior of Tutoring Systems. 39.

2.3 Found Via

Research Guide

2.3 Summary

Description of the basic principle all intelligent tutoring system use. The concepts of an inner loop, and an outer loop. The inner loop is where the system give hints and feedback at each step. While the outer loop uses information from the inner loop to select which task the learner should be presented with.

2.3 Take Aways

The dream of intelligent tutoring systems (ITS) is to replace human tutors. In terms of economic empowerment, ITS's could be accessed by a larger amount of people, as opposed to human tutors. This paper attempts to set a standard to the terms most ITS's use, as to reduce the mental energy required to understand these systems

2.4 Paper

Murray, T. (2003). An Overview of Intelligent Tutoring System Authoring Tools: Updated Analysis of the State of the Art. In T. Murray, S. B. Blessing, & S. Ainsworth (Eds.), *Authoring Tools for Advanced Technology Learning Environments* (pp. 491–544). Springer Netherlands. https://doi.org/10.1007/978-94-017-0819-7_17

2.4 Found Via

Research Guide

2.4 Summary

A compilation of intelligent tutoring systems (ITS). Attempt to categorize approximately 24 ITS's into categories based on tradeoffs. Categories include Curriculum Sequencing and Planning, Tutoring Strategies, Device Simulation and EquipmentTraining, Domain Expert System Multiple Knowledge Types, Special Purpose, Intelligent/Adaptive Hypermedia

2.4 Take Aways

The research proposed here could be used to help better understand where a potential project could fit. By understanding the strengths and weaknesses of each category, the potential solution created as part of this course could be clear on what it does, and what it doesn't do.

2.5 Paper

Azevedo, R. (2002). Beyond intelligent tutoring systems: Using computers as METAcognitive tools to enhance learning? *Instructional Science*, *30*(1), 31–45. https://doi.org/10.1023/A:1013592216234

2.5 Found Via

Research Guide

2.5 Summary

This work is focus in 2 areas. One, focuses on the lack of contextual clarity of the proposed construcvist stance. Two, attempts to address the similarity in approaches and and stances on cognition and educational computing.

2.5 Take Aways

The abreact, to me, did not read verify well. I wasn't left with a good picture of what I would learn if I continue to read the entire paper. This work seems focused on consolidating approaches and stances on existing work, and the author sees fit. Which might not be the best thing to research as the Author may inject their own biases.

2.6 Paper

Ritter, S., Koedinger, K. R., Hadley, W., Corbett, A. T., & Lilly, M. (n.d.). *Classroom Integration of Intelligent Tutoring Systems for Algebra and Geometry*. 17.

2.6 Found Via

Research Guide

2.6 Summary

Describes the process of the integration between teacher, student, agent (cognitive tutor), and the content. Content is generated by the cognitive tutor for the purpose of being what the student learns over the course. The student then spends 40% of their class room time interacting with the cognitive tutor.

2.6 Take Aways

The software (cognitive tutor) is viewed as a first class citizen of the curriculum. Thus because the agent learns from the student as their progress, concepts like constructionism take hold. This is some interesting work in the application of a cognitive tutor in the specific domain of Algebra.

2.7 Paper

Huang, H. (2002). Toward constructivism for adult learners in online learning environments. *British Journal of Educational Technology*, *33*(1), 27–37. https://doi.org/10.1111/1467-8535.00236

2.7 Found Via

Research Guide

2.7 Summary

The paper attempt to address the differences adults face in an online learning environment. This work illustrates that the same content taught an online platform would be consumed differently by adults vs children. It also suggests that constructivism be used in an online learning environment.

2.7 Take Aways

This paper has some very interesting topics. Especially given the time we are in with COVID-19, more and more generations are consuming content in what some may describe as "abnormal" channels given the generation they come from. So the online learning environment should be different for different generations of people, as in, the content should be tailored to the learner. Which is a the core of constructivism.

2.8 Paper

Bruckman, A., & Resnick, M. (1995). The MediaMOO Project: Constructionism and Professional Community. *Convergence: The International Journal of Research into New Media Technologies*, *1*(1), 94–109. https://doi.org/10.1177/135485659500100110

2.8 Found Via

Research Guide

2.8 Summary

Describes the word being done around MediaMoo. An online learning environment what participates must have applied, and been accepted. The work concentrates on the idea that learners engage when the projects are personally meaningful.

2.8 Take Aways

Interesting work around attempting to match the learners passions, with the content itself. In doing so, attempts to borrow some of the ideas around constructivism. While interesting, might not be ideal for systems that are in the domain that institutions believe all people must know, essentially, what about the case where the learner is not passionate about the material?

2.9 Paper

Hernández-Ramos, P., & De La Paz, S. (2009). Learning History in Middle

School by Designing Multimedia in a Project-Based Learning Experience. *Jour-*

nal of Research on Technology in Education, *42*(2), 151–173. https://doi.org/10.1080/15391523.2009.10782545

2.9 Found Via

Research Guide

2.9 Summary

This work is around a specific implementation of project based learning in a middle school where a group of 8th graders were used in an experiment where they were to do projects based on mini-documentaries around 19th century US history. Results showed that, learners who participated in the project based learning did better on knowledge based tests

2.9 Take Aways

Personal experience is in line with the results of this work. I do my best work in the project based environment. That is much of the reason I took this course. This work is anecdotal evidence project based learning works.

2.10 Paper

Analysis of student behavior in learning management systems through a Big Data framework. (n.d.). https://doi.org/10.1016/j.future.2018.07.051

2.10 Found Via

Google Scholar Search, "Learning Management System"

2.10 Summary

Work covers the collection of ~70GB of activity data. Data was collected via a Learning Management System (LMS) over a 4 year period for student in-person, online, and blended. The Authors used Big Data techniques for collection and analysis. Data showed that over the 4 years "On-Campus" students generated more events than Online or Blended.

2.10 Take Aways

As the research has evolved, LMS's have become a new area of focus. This work shows that there is addition research being done in this area, which could

be used a starting point for my work. This could lead into work around extending Canvas, once more research is complete.

2.11 Paper

Frost, R. D., Matta, V., & MacIvor, E. (2015). *Assessing the Efficacy of Incorporating Game Dynamics in a Learning Management System*. *26*, 13.

2.11 Found Via

Google Scholar search for "Learning Management System"

2.11 Summary

Applying Gamification concepts to the an LMS as to increase a learners interaction. The system included 4 main points. One, Hero story line with quests (assignments and assessments). Two, badges for individual grades. Three, points earned on a game-like scale (100,000 for course). Four, leaderboard of anonymous names. Results showed that student appreciated some gamification aspects, however quantitative data suggests no effect on variables measured.

2.11 Take Aways

Very interesting idea. I think there might be something here in-terms of a project for this course. The results from this work are concerning. However, some of the aspects of this work might have been viewed a gimmicky from the learners perspective.

2.12 Paper

Madhavi, K., Murthy, J. N., Raju, N. V. G., Kumar, G. S., Praveen, J., & Raju, K. V. S. (2019). Facilitating and Adapting Learning Management System: A Novel Experimental Study. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3375708

2.12 Found Via

Google Scholar Search, "Learning Management System"

2.12 Summary

This works discusses the role LMS's play in a learning environment. The work summarizes the purpose of one specific LMS, Moodle. The Authors discuss topics from what Moodle is, how it was implemented, and challenges through this process.

2.12 Take Aways

This work can give me a better understanding of how LMS's are adopted, and the challenged associated. They illustrate challenges around rural student, and less technical students. Theses are important things to think about and address when creating technology.

2.13 Paper

Zheng, J., & Brian, H. (2019). Identity Atheneum: Combining User Management, Analyticsand Gamification in a Multi Tool Hub. *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, 620–626. https://doi.org/10.1145/3287324.3287398

2.13 Found Via

Google Scholar, "Learning Management Systems & Gamification"

2.13 Summary

This work describe a system which identifies student through not only a LMS, but all other systems integrated with the LMS. The Authors describe a system that is a central hub for identifying student through out the learning process, across all the tools the learners use. In doing this, better data collection, and gamification protocols can be applied.

2.13 Take Aways

This work deserves further investigation. Having a consistent way to identify a learners work across many looks can make any additional system built on top o this system more robust which could lead to better adoption of the tool. This is also one less thing I would have to worry about if my system were to integrate with the system described in this work.

3. ACTIVITY

3.1 Paper

Zheng, J., & Brian, H. (2019). Identity Atheneum: Combining User Management, Analytics and Gamification in a Multi Tool Hub. *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, 620–626. https://doi.org/10.1145/3287324.3287398

3.1 Need

A reliable & constant way to identify students through the tools they use. This allows for more reliable data collection, and effort attribution. The work grew out of the need to reward students for participating and interacting with the different tools not only within the tools, but between the tools.

3.1 Method

The Authors of this work created a User Management system which stores information about users and integrates with the tools the learners use. The system also works with existing tools such as TrAcademic, which is a tool a teacher can use to game-ify the learning experience.

3.1 Audience

The system focuses on students and identifying them across a number of tools. It also is a tool for teachers and school admins for managing access, points (in some cases), in a central place rather than in each tool. The system also has the ability to export results such that school admins can view student activity.

3.1 Results

The system is open-sourced, and appears to be usable as it is under active development. For tools that are looking to work with this system , they are encouraged to reach out to the Authors.

3.1 Critique

AS for alignment, I can't think of anything as this system seems to check all the boxes from the need, to the implementation. A minor issue might be around

trying to use this tool for this project as it requires communication with the Authors, which might be problematic.

3.2 Paper

Frost, R. D., Matta, V., & MacIvor, E. (2015). *Assessing the Efficacy of Incorporating Game Dynamics in a Learning Management System*. *26*, 13.

3.2 Need

This work focuses on the need of engaging, motivating, and satisfying student via gamification concepts. The Authors attempted 4 different techniques for achieving this. Also, the need of increasing the number of desired outcomes.

3.2 Method

1) Hero adventure storyline
2) Olympic colored badges to represent individual grades
3) Points earned on a game scale
4) Leaderboard

3.2 Audience

Mostly centered around students, which teachers & admins as the stakeholders around the data collected.

3.2 Results

Results were captured in 2 different ways, qualitative, and quantitative. The qualitative approached used a survey the student completed and showed an appreciation of the gamification concepts adopted. While the quantitative approach suggested no measurable affect on desired outcomes.

3.2 Critique

This work is centered around one population of students, using one approach of game-ify the learning process. The results seem to indicate an unsuccessful

implementation. This could be due to many different things, the student population, the application of gamification concept, etc.

3.3 Paper

Ritter, S., Koedinger, K. R., Hadley, W., Corbett, A. T., & Lilly, M. (n.d.). *Classroom Integration of Intelligent Tutoring Systems for Algebra and Geometry*. 17.

3.3 Need

An ITS (Intelligent Tutoring System) which generates content, tracks students progress, and presents content at a pace custom to the learners progress.

3.3 Method

A software system for tracking or "watching" a student as they progress through the learning content. The system only intervenes when it has decided the student is confused or developing a misconception. Upon this decision the system intervenes with a message setting the learner back on track. Alternatively the student can request hints which the system provides.

3.3 Audience

Primary focus is students and the learning process. However, the system also contains tools for the teacher to help in the learning process. It is unclear if the system provides analytics back to the teach, though this is assumed.

3.3 Results

This works results show that students taught with the Cognitive Tutor (CT) significantly out performed student what were not taught with the CT (Table 1 in paper)

3.3 Critique

This work seemingly delivers on the need it described as developing a CT system that assists students in the learning process. As this work was completed in 2004, there may be an opportunity to "refresh" this work approximately 16 years later

3.4 Paper

Analysis of student behavior in learning management systems through a Big Data framework. (n.d.). https://doi.org/10.1016/j.future.2018.07.051

3.4 Need

Processing large amounts of event data generated over 4 years form the Catholic University of Murcia. With the usage of LMS (Learning Management Systems) becoming more and more popular, having systems in place to process this data such that meaningful insights can be gathered is critical.

3.4 Method

The approach leverages existing Big Data tools such as Hadoop, Sqoop, and MySQL to process, store, and analyze events data gathered from a LMS.

3.4 Audience

The audience of this work is unclear. While the data comes from student interacting with an LMS, the insights, and needs are more focused around describing a process for gathering, parsing, and analyzing data which has a non-traditional audience (traditional being student, teacher, school admin).

3.4 Results

As this work is just a declaration of a process applied to a specific dataset, the results are seemingly less impactful in terms of driving a decision on what project to adopt for this course. This work describes a larger need for systems to be able to parse, and understand the data LMS's gather such that meaningful insights can be extracted.

3.4 Critique

This work fall outside of the initial bounds set by other work exampled in this section of the assignment. However, the reason it was picked for further examination was to show a need of Big Data in processing data from LMS's. In that regard this work is good, however not much action in terms of this project can be taken.

3.5 Paper

Madhavi, K., Murthy, J. N., Raju, N. V. G., Kumar, G. S., Praveen, J., & Raju, K. V. S. (2019). Facilitating and Adapting Learning Management System: A Novel Experimental Study. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3375708

3.5 Need

This work attempts to understand the LMS, Moodle. It attempts to describe the challenges in implementing a LMS specifically around rural students, and non-technical students. Overall this work describes LMS's and the challenges associated.

3.5 Method

Completing, and describing experiments around e-learning the the systems involved in implementing them.

3.5 Audience

While not clearly stated, this work's audience would be school admin's looking to better understand the challenges in implementing a LMS. The results of this work could be used to decide if a LMS is the proper use of a schools monetary resources.

3.5 Results

Overall adopting was slow, over the course of a few years, with the last year being the highest in terms of adoption. The Authors deem this a success in the experiments they cover in this work. This works

3.5 Critique

This works shows the importance of Learning Management Systems. However the audience is unclear, and was largely inferred.

References

Papert, S. (n.d.). Children, Computers, and Powerful Ideas. 11.

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