

**Satori: Open-source Course Management System**  
(Technical Paper)

**Technological Momentum of Online Education: How Student Experiences Have Evolved  
Over Time Through Online Instruction**  
(STS Paper)

**A Thesis Prospectus Submitted to the**

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On my honor as a University Student, I have neither given nor received  
unauthorized aid on this assignment as defined by the Honor Guidelines  
for Thesis-Related Assignments

## Introduction

The COVID-19 global pandemic has affected the lives of millions of people worldwide. Out of almost 3000 universities investigated by *The Chronicle of Higher Education*, over 60% incorporated online learning into their Fall 2020 semester (“Here’s Our List of Colleges’ Reopening Models”, 2020). Researching how students navigate and handle the transition to learning remotely has become more prevalent as technology usage in classes has grown, but the COVID-19 pandemic has forced society to become more dependent on technology. The University of Virginia is one institution where many courses have been transitioned online. For the course Program and Data Representation, known as CS 2150, being able to efficiently provide support to students remains a priority. The technical project described in this prospectus consists of the continuation of previous work on an online platform that will hold course tools, such as the office hours queue for CS 2150. With this feature, students will be able to request assistance during scheduled times, and Teaching Assistants (TA’s) have the ability to assign and unassign students to themselves. A ticketing system to help instructors and TA’s respond to student requests will be added to the course management system.

Students play an essential role in the potential growth of online education. Differences between students’ circumstances, such as a student’s financial situation or access to internet, can cause them to face different challenges in education, which can be even harder to overcome while learning online. Education represents a significant aspect of society, seen as “the foundation of society” (Idris et al., 2012, p. 443). Examining the relationship between education and technology utilized in remote instruction can provide information that will assist in further progression of online education. Researching how education and technology interact combined with student opinion can ensure progression of online learning only occurs with student

satisfaction to prevent the creation of new problems that were not commonly seen before. The project that is described in the STS Topic section of this prospectus will include research on online education during COVID-19 using technological momentum, and will also explore its development over time.

### **Technical Topic**

Currently, CS 2150 employs “Course Tools,” a course management system made in the early 2000s. The class size continues to grow (from around 200 to 500 students), but the initial office hours queue was not created to handle the sheer volume of students during busy office hour times. The system becomes glitchy, with problems including students being kicked off the queue randomly, the queue freezing at inconsistent times, and having a slow response time during busy office hour times. Furthermore, the support request tool also has a slow response time when there is a large amount of student request tickets in the system and is not compatible with the new system called Gradescope that the instructors use for automatic assignment grading and feedback.

Last year, work began on an open-source online course management system called “Satori,” which was designed to replace “Course Tools.” For the technical project, the research team will be building onto that system. This project will be directed by Professor Aaron Bloomfield in the Computer Science department in the School of Engineering and Applied Sciences. The project is mainly focused on building onto the office hours queue for students to add themselves to when they need help on assignments, as well as creating a ticketing system for student requests if they need an extension on an assignment or need to reach out to the course staff directly. These features are adaptations of similar existing tools used in CS 2150. Improvement on these features will help large courses be able to manage students and allow the

course staff to interact with and help as many students as possible, as studies have shown that going to office hours increases students' overall learnings and scores in the course (Guerrero & Rod, 2013).

The existing "Satori" platform was created on Django, a Python web framework, uses MySQL to create and manage the database, and is hosted in a Docker container. The project is divided into three apps -- core, queue, and tickets -- with a user-friendly interface. Core handles creating and editing courses, and upholding role and user permissions. The queue app consists of the office hours queue system. Tickets will be used for the support request system. We plan to test the web application once each feature is done, starting with the 50 CS 2150 teaching assistants, and when that is successful, it will be made available to the over 530 students who are currently taking this course. Once the web application and research are completed at the end of next semester, the technical report will be written. The team hopes that by using this system, instructors and students will be able to have an easier-to-use and more cohesive course management system, especially with the course being completely online due to the COVID-19 global pandemic. Another goal of the project is to advance the student experience in order to improve their opinions on online learning as well as academic performance.

### **STS Topic**

Technological innovations have become integrated into almost every aspect of people's everyday lives. The way people communicate with each other has become digitized, transportation now relies heavily on technology, and technology provides tools in education (Alalshaikh, 2015). In 2020, a new virus, COVID-19, has created a global pandemic that has forced people to adapt to new changes. In order to limit the spread of the disease, people must limit their interactions with others, and this has led to many school closures. Teachers and

students are now forced to adapt to these new changes, with many institutions moving to a virtual format, so education can continue without risking the lives of their students and employees.

Online learning existed prior to COVID-19, but it has not been used to the same degree that was necessary to respond to the global pandemic. Alalshaikh (2015) discusses different forms of distance education, with online learning being one of them. He describes online learning as the “more contemporary version of distance learning that enhances access to educational opportunities for nontraditional and even unprivileged learners” (Alalshaikh, 2015, p. 71). Online learning has allowed students to continue learning, and develop skills that will help them face society’s demands (Schneider & Meirovich, 2020). However, students face many barriers to learning that are created or facilitated by online instruction. The exclusion of interactions between students with their peers as well as with their instructors can lead to students easily getting bored or distracted, which will affect the effectiveness of their learning (Chang, 2020). Students who grew up in different societal backgrounds also have to face different challenges; for example, some households may have limited access to the Internet (Silva, 2020), and international students have to navigate different time zones (Eidt, 2020). Combatting students’ challenges and responding to their opinions is important to the success of online education.

Education represents an important component of society; Hoadley (2016) claims that “learning is more of a social process than a mental one” (p. 31). Cloete identifies technological development as the “most important factor in initiating and expanding distance, online and blended learning” (2017, p. 2), which suggests that technology shapes society. Dabbagh discusses the way that “telecommunication technologies and social constructivist learning

principles premised a pedagogical ecology” (2004, pp. 27-28) that encompasses the changes within distance learning. Examining student opinions on online learning over time can help identify the relationship between technology and education. Technological momentum will be used as the framework for this research and analysis. Technological momentum, coined by Thomas P. Hughes, “infers that social development shapes and is shaped by technology” (p. 102). Technological determinism is another idea that instead claims “technical forces determine social and cultural changes” (Hughes, 1994, p. 102). Social constructivists assert that the opposite is true, where “social and cultural forces determine technical change” (Hughes, 1994, p. 102). Technological momentum takes characteristics of both social construction as well as technological determinism without restricting the relationship between technology and society to one resembling cause and effect (Hughes, 1994); it can fill the gap that exists between technological determinism and social construction. This view on technology and society also allows for complexity with the include of the element of time that drives momentum (Hughes, 1994). Opponents of technological momentum argue that it is at its root technological determinism because technology is still placed at a central position, but Hughes argues that society and technology are equally influential to each other (1994). Analyzing student opinions and experiences over time using technological momentum as a lens can help identify trends within online education and create the potential to solve problems that currently exist within the field.

### **Research Question**

Research Question: How has the relationship between education and instructional tools influenced students’ opinions and experiences pertaining to online learning over time?

### **Methods**

The main methods that will be used to respond to the research question above are the analyses of historical case studies as well as discourse analysis. Discourse analysis will allow for the incorporation of opinion pieces and news articles into the research paper. As the research topic relates to opinions and experiences of students, incorporating pieces from student perspectives will offer effective insights. Historical case studies will help display the changes in student experiences and opinions pertaining to online education over time. One case that will be used is a 2004 study conducted by Shin & Chan at the Open University of Hong Kong that investigated different measurements such as student participation and satisfaction in their online courses. Another case study will be conducted on a 2016 survey that looked at the impact different student environments had on their online learning experience (Gemmell & Harrison). A more recent case is one conducted during the COVID-19 global pandemic, which consisted of surveying students in Indonesia and Malaysia (Ana et al., 2020). Further research will be conducted to find additional relevant cases. Different keywords will be used, such as “online learning”, “e-learning” and other forms of distance education. These words will be combined with “COVID-19” or “pandemic” to find more recent information. For older cases, words like “study” or “survey” may be used.

## **Conclusion**

This paper outlines plans for two projects, one with a technical deliverable and one with a research paper deliverable. Previous work has already been done on the course tools platform for the course, CS 2150: Program and Data Representation, by a previous group who implemented the office hours queue. Development will build on top of the existing system, and additional features will be added as well. This queue aims to improve the student experience in the course, and will help students receive help quickly and efficiently during the pandemic.

Research into student opinions and experiences with online learning over time can provide insight about patterns within the relationship between technology and education. Exploration into this may potentially help solve long-lasting issues and prevent future ones. The technological momentum framework helps connect these trends with the relationship between society and technology. Identifying and determining ways to combat existing issues will be beneficial to future expansion of technology in the field of education.



## References

- Alalshaikh, S. (2015). Cultural Impacts on Distance Learning, Online Learning Styles, and Design. *The Quarterly Review of Distance Education*, 16(3), 67–75.
- Ana, A., Purnawarman, P., Saripudin, S., Muktiarni, M., Dwiyantri, V., & Mustakim, S. S. (2020). Students' Perceptions of the Twists and Turns of E-learning in the Midst of the Covid 19 Outbreak. *Revista Românească Pentru Educație Multidimensională*, 12(1), 15–26.
- Chang, H.S. (2020). Online Learning in Pandemic Times. *Revista Romaneasca pentru Educatie Multidimensionala*, 12(2Sup1), 111-117. <https://doi.org/10.18662/rrem/12.2Sup1/296>
- Cloete, A.L. (2017). Technology and education: Challenges and opportunities. *HTS Teologiese Studies/ Theological Studies*, 73(4), a4589. <https://doi.org/10.4102/hts.v73i4.4589>
- Dabbagh, N. (2004). Distance Learning: Emerging Pedagogical Issues and Learning Designs. *The Quarterly Review of Distance Education*, 5(1), 37–49.
- Eidt, L. (2020, September 8). *International students study through time zones and changes*. <https://www.thelantern.com/2020/09/international-students-study-through-time-zones-and-changes/>.
- Gemmell, I., & Harrison, R. (2016). A comparison between national and transnational students' access of online learning support materials and experience of technical difficulties on a fully online distance learning master of public health programme. *Open Learning: The Journal of Open, Distance and e-Learning*, 32(1), 66–80. <https://doi.org/10.1080/02680513.2016.1253463>

- Guerrero, M., & Rod, A. (2013). Engaging in Office Hours: A Study of Student-Faculty Interaction and Academic Performance. *Journal of Political Science Education*, 9(4), 403 - 416. <https://doi.org/10.1080/15512169.2013.835554>
- Here's Our List of Colleges' Reopening Models*. (2020, October 1). <https://www.chronicle.com/article/heres-a-list-of-colleges-plans-for-reopening-in-the-fall/>.
- Hoadley, C. (2016). Online Pedagogy from the Learning Sciences Perspective. *The SAGE Handbook of E-Learning Research*, 25–43. <https://doi.org/10.4135/9781473955011.n2>
- Hughes, T. P. *Technological Momentum*. (1994). Cambridge, Massachusetts. London, England. The MIT Press.
- Idris, F., Hassan, Z., Ya'acob, A., Gill, S. K., & Awal, N. A. M. (2012). The role of education in shaping youth's national identity. *Procedia - Social and Behavioral Sciences*, 59, 443–450. <https://doi.org/10.1016/j.sbspro.2012.09.299>
- Schneider, L. N., & Meirovich, A. (2020). Student Guided Learning - from Teaching to E-learning . *Revista Românească Pentru Educație Multidimensională*, 12(1), 115–121. <https://doi.org/10.18662/rrem/12.1sup2/254>
- Shin, N., & Chan, J. K. Y. (2004). Direct and indirect effects of online learning on distance education. *British Journal of Educational Technology*, 35(3), 275–288. <https://doi.org/10.1111/j.0007-1013.2004.00389.x>
- Silva, N. R. (2020, October 1). *Distance Learning and Cultural Capital*. Diverse. <https://diverseeducation.com/article/189320/>.