

Assignment 1:CS6460

Ajit Kumar Yadav
ayadav85@gatech.edu

RESEARCH-LOG

BACKGROUND

Since 2010, I have been taking care of my family's k12 school situated in a village setting catering to a huge population with low socio-economic status. Within the same time frame (from 2010 to 2014), I also had a short stint as an assistant professor at a private university near Delhi (India's Capital). Having worked in both contexts, I realized that we need to strengthen classroom learning at primary level (especially in the STEM field) to make a smooth transition in professional courses. Improving classroom instruction in the absence of an expert teacher is a huge challenge, so alternatively I started thinking about integration of technology in the curriculum (hybrid classroom). In the short term, I would like to explore the best possible instructional strategy and assisted technology to deliver course content. In the long term, I expect to explore areas like learning sciences, cognitive sciences, and cognitive modeling. How do these areas shape up the learning process of students and make way for intelligent tutors?

PAPER1

Bibliographic Information

Leanna Archambault, Heather Leary & Kerry Rice (2022) Pillars of online pedagogy: A framework for teaching in online learning environments, Educational Psychologist, 57:3, 178-191, DOI: 10.1080/00461520.2022.2051513.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

The author talks about foundational building blocks of effective online pedagogy. To design such pedagogy, primary importance has been given to learner-centeredness, constructivism, and situated learning.

Main Takeaways

After reading the article, I understood whether it's a physical classroom or online classroom, peer discussion and collaboration among teachers and students are of prime importance. At the same time, we must focus on active learning situated in real world problems.

PAPER2

Bibliographic Information

Chen, B., Bastedo, K., & Howard, W. (2018). Exploring design elements for online STEM courses: Active learning, engagement & assessment design. *Online Learning*, 22(2), 59- 75. doi:10.24059/olj.v22i2.1369.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

The purpose of the study was to understand what the main components or design elements for effective online courses in STEM are, which is also aligned with the Universal Design for Learning principle (aka UDL). It also discusses the weightage of each design element.

Main Takeaways

Study talks about Active Learning, Engagement and Assessment as three main elements to focus upon while designing online courses. To support these design elements within coursework, video and other forms of multimedia use has been given prime importance.

PAPER3

Bibliographic Information

Sonya E. Van Nuland, Elissa Hall, Natalie R. Langley (2020). STEM crisis teaching curriculum design with e-learning tools.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

In this study the author presents a simple framework (aka Backward Design model), which may be helpful in choosing different e-learning tools based on given context, subject and target audience.

Main Takeaways

By offering a backward design table, researchers help teachers and policy makers to shortlist e-learning tools. The whole process of selecting tools has been based on 3 factors: a) desired learning results b) Evidence that tool has the functionality to support desired result c) Planning appropriate instruction.

PAPER4

Bibliographic Information

Sonya E. Van Nuland, Elissa Hall, Natalie R. Langley (2020). STEM crisis teaching: curriculum design with e-learning tools.

Source (Google Scholar etc)

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PAPER5

Bibliographic Information

Isha Decoito, Mohammed Estaiteyeh (2022). Online teaching during the COVID-19 pandemic: exploring science/STEM teachers' curriculum and assessment practices in Canada. *Disciplinary and Interdisciplinary Science Education Research* (2022) 4:8

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

This paper examines the experience of teachers in Canada towards online teaching during COVID-19. The TPACK framework has been used to understand teacher's efficacy and overall preparedness, However, teachers' experience was not very encouraging and further research is needed to understand the main hindrance towards online teaching.

Main Takeaways

In this study I came to know about the TPACK model that is designed to help teachers prepare for online teaching during COVID shutdown. TPACK gives a detailed understanding of what knowledge is required to deliver effective online courses. It is a foundation upon which teacher training can be based in future.

PAPER6

Bibliographic Information

T.J. Kennedy, M.R.L. Odell (2014): Engaging Students in STEM Education: Science Education International Vol. 25, Issue 3, 2014, 246-258

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

This paper outlines necessary attributes in designing STEM programs that may engage all students. Emphasis is given to project-based learning as a prime design attribute and T-STEM as a framework has been chosen to support the development of the program.

Main Takeaways

High quality STEM programs must reflect the following qualities: engineering design and problem solving, inquiry-based learning, connection with the real world and support for the broader STEM community. To achieve these qualities, out of so many frameworks, T-STEM has been suggested as a framework to investigate further.

PAPER7

Bibliographic Information

Pei-Chen Sun, Ray J. Tsai , Glenn Finger , Yueh-Yang Chen , Downing Yeh (2008): What drives successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & Education 50 (2008) 1183–1202

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

The study explores the associated factors for low utilization and low satisfaction towards e-learning tools. This study focuses on six dimensions, and also suggests where more work is needed to bring better satisfaction among learners. These six core dimensions include learner, instructor, course, technology, design, and environment.

Main Takeaways

The study revealed that teacher's attitude, course quality, usefulness, and ease of use are the main factors that must be improved by offering more training focused in these areas to improve learner's satisfaction.

PAPER8

Bibliographic Information

Veenita Shah, Sahana Murthy, Jayakrishnan Warriem, Sameer Sahasrabudhe, Gargi Banerjee, Sridhar Iyer. (2022): Learner-centric MOOC model: a pedagogical design model towards active learner participation and higher completion rates. Education Tech Research Dev (2022) 70:263–288

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

This study explores the reason as to why dropout rate among MOOC learners is so high. They join the course but lose interest soon after joining. Furthermore, it explores few strategies to develop learner-centered courses on MOOC.

Main Takeaways

Any learner-centered MOOC course must focus in following areas: 1) problem centric learning with clear exposition 2) instructor accessibility and passion 3)

active learning 4) peer interaction 5) using varied helpful course resources 6) bit-sized videos.

Furthermore, study suggests a new learner-centric model for MOOC based on following pillars: a) learner experience interaction b) learning dialogue c) learning by doing d) learning extension trajectories.

PAPER9

Bibliographic Information

Charles Xiaoxue Wang (2020): CAFE: An Instructional Design Model to Assist K-12 Teachers to Teach Remotely during and beyond the Covid-19 Pandemic. Tech-Trends (2021) 65:8–16.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

During COVID-19, schools were forced to close, and teachers were forced to deliver online instruction on very short notice. To assist teachers in remote teaching a 'CAFÉ' model was designed. This study explores the context in which this model was experimented and how it helped teachers in delivering their content.

Main Takeaways

The CAFÉ model consisted of 4 main tasks: 1) Content 2) Activities 3) Facilitation 4) Evaluation. Teachers were trained to break their instruction in these areas (for example, contents to cover each week, activities planned for those contents etc) in smaller chunks so they could smoothly transition to online delivery. This model can be helpful to beginner teachers in categorizing their instructions.

PAPER10

Bibliographic Information

Ignasia Yuyun(2018). Curriculum and Technology Design: A Course to Explore Technology Applications in EFL Curriculum Design. Journal of ELT Research · February 2018.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

This experimental study focuses on the design of English as Foreign Language Course using technology. Technology Enhanced Language Learning and TPACK (Technological, pedagogical, and content knowledge) framework has been used in designing its course content.

Main Takeaways

In this course design, various technical tools have been applied, for example, to draw 2D content mapping Canva is used. Prezi, Quizlet, and other tools are used for presentation. The result shows that technology knowledge is still required for teachers, and more training materials are needed. Technology based applications have the potential to enhance a student's creativity and thinking skills.

PAPER11

Bibliographic Information

Guzey, S. S., Moore, T. J., & Harwell, M. (2016). Building Up STEM: An Analysis of Teacher-Developed Engineering Design-Based STEM Integration Curricular Materials. *Journal of Pre-College Engineering Education Research (J-PEER)*, 6(1), Article 2.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

It is an analysis of the effectiveness of STEM course content developed by in-service teachers. Engineering design is used to structure these curriculum units. Each STEM unit was focused on one of the three science content areas: life science, physical science, and earth science. Study shows physical science focused STEM courses found to be more engaging.

Main Takeaways

This reform effort advocates for integration of technology in STEM subjects. This interdisciplinary approach may increase conceptual understanding within the discipline and support interest development among students.

PAPER12

Bibliographic Information

Robert bodily, Heather Leary, Richard E West (2019): Research trends in instructional design and technology journals. British Journal of Educational Technology doi:10.1111/bjet.12712 Vol 50 No 1 2019 64–79.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

Researchers used an online Scopus database to retrieve all instructional design and technology scholarships between 2007 and 2017 across 65 journals. Their objective was to understand the trend in educational technology research and what dimension needs to be further explored to understand the 21st century research direction.

Main Takeaways

Looking at past research, the author finds that there is a large focus on computer-based technology. But there is a lack of recent scholarship in learning theories and design framework. More connected research from different fields (learning science, psychology, technology etc) are needed to get some evidence on what makes technology-based learning better than traditional classroom, if true.

PAPER13

Bibliographic Information

Kevin mulqueeny, Victor Kostyuk, Ryan S Baker, Jaclyn Ocumpaugh (2015): Incorporating effective e-learning principles to improve student engagement in middle school math. International Journal of STEM Education (2015) 2:15.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

In this study, using e-learning principles like Personalization, Modality, and Redundancy; One middle level math app has been redesigned (named as Genie 3). Post analysis shows that student engagement has improved a lot in comparison to previous versions.

Main Takeaways

In Genie3, conversation between tutor and student took place in natural language form, immediate feedback modality was changed from text to voice. These changes depict that in improved versions students are having human-like interaction and hence engagement is improved as outcome.

PAPER14

Bibliographic Information

Reza Hadi Mogavi, Yankun Zhao, Ehsan Ul Haq, Pan Hui, Ma (2021): Student Barriers to Active Learning in Synchronous Online Classes: Characterization, Reflections, and Suggestions. L@Scale 3: Perspectives from Oceania L@S'21, June 22–25, 2021, Virtual Event, Germany.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

This study analyzes the shortcoming of online learning systems in general, which may hinder the learning process of students. These shortcomings have been categorized into 3 areas: human factors, technology factor, environmental factor. For example, a human factor example is staying focused, a technology factor example is timely feedback, environmental factor example may be considered as screen time etc.

Main Takeaways

Through Recent advances in technology, we have been able to overcome a few issues like feedback loop, interaction with the system etc. However, we still need to work on other dimensions and this study gives an initial foundation of knowledge as to where to put more focus.

PAPER15

Bibliographic Information

Drew Polly (2011): Teachers' learning while constructing technology-based instructional resources. British Journal of Educational Technology. Vol 42 No 6 2011 950–961.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

Grounded in the constructionist paradigm, study analyzes the experience of primary teachers while creating technology rich instructional materials. Instructional materials were created by using the TPACK framework.

Main Takeaways

It was learning by doing activities for teachers. While constructing the materials, their knowledge of the TPACK framework deepened. They were observed to have

sufficient technical knowledge and be able to connect TPACK contents with instructional strategy. It reemphasizes the importance of the TPACK framework for today's teachers.

PAPER16

Bibliographic Information

Richard E West, Rebecca A Thomas, Robert bodily, Casey Wright, Jered Borup (2016): An analysis of instructional design and technology departments. Education Tech Research Dev DOI 10.1007/s11423-016-9490-1.

Source (Google Scholar etc)

Google Scholar

Brief Original Summary

This paper explores the research work that is happening (in recent years) especially in the Department of Instructional Design and Technology. It is an effort to synthesize departmental efforts and also understand the direction of future research in instruction and technology .

Main Takeaways

By reading this paper, researchers will be able to explore prominent researchers and their work in instructional and technology design. Researchers found that pedagogical design and theories were the most popular topic at that time and most of the studies come from higher education.

SYNTHESIS

My main interest lies in exploring instructional design embedded into technology that may deepen student's learning in the hybrid or in fully online mode. I can elaborate my understanding in two major areas: 1) Teacher's current state of preparation and need of the future (as mentioned in TPACK and T-STEM framework), towards the use of technology while creating instructional units. 2) Key elements in designing e-learning content that improve overall student's learning.

There is lots of research work that is solely focused on teachers training program such as TPACK and T-STEM (pawat et al. 2022) and similar frameworks. The objective is to make teachers experts in technology use. It gives a good foundational knowledge to novice teachers to start on an e-learning journey. However, there is less research that may suggest how to select e-learning tools given a specific subject or topic. If we can facilitate teachers with evidence-based teaching tools that cover core principles of learning, it will make their job more productive as they will be able to focus on classroom contents, further experimental research is needed in this area.

On the basics of student's optimal learning condition, research suggest that pedagogical strategies must reflect learner-centeredness, constructivism, and situated learning (Leanna et al., 2022; Chen et al., 2022; Isha et al., 2022; Kennedy et al., 2014). Learner-centeredness (Shah et al. 2022) has been given prime importance in most of the current research. In a technology driven learning environment, good learning consists of: 1) active learning 2) cultivating relationships 3) learner autonomy 4) mastery learning 5) personalization 6) self-reflection 7) creativity 8) apply theory learnt to practice (Shah et al. 2022).

Going further, I have to understand current frameworks (for example, T-STEM) in use. How effective is it in my context? And what changes are required to bring

these successful strategies into my local context.

REFLECTION

Having read various research over the years I have come to understand that appropriate use of technology enhances a student's learning. So, currently I am more interested in finding use cases or the evidence of use of technology and pedagogical strategies. I see little concrete research in this area, perhaps this is still a trajectory to explore, since online learning has just started as mainstream learning. However, I have found some books, which reflect on technology and related pedagogical strategies in depth and I may develop more clarity after reading those books.

PLANNING

Moving forward I would like to explore more on specific subjects (for example Math and Science), what sorts of e-learning tools and curriculum design bring major changes into a student's learning outcome? What parameters of learning get affected (for example, problem solving skills, teamwork etc)? What sorts of technology touch upon other parameters like empathy, creativity etc. How to offer personalized immediate feedback as the student progresses in their tasks? Overall, how to offer each student a personal tutor available 24 by 7.

ACTIVITY

PAPER 1

Pei-Chen Sun, Ray J. Tsai , Glenn Finger , Yueh-Yang Chen , Downing Yeh (2008):
What drives successful e-Learning? An empirical investigation of the critical
factors influencing learner satisfaction. Computers & Education 50 (2008) 1183–
1202. <https://doi.org/10.1016/j.compedu.2006.11.007>

Need

Since COVID-19, many schools and institutions took online learning as mainstream education. It's growing day by day. Looking at the trend, it has become very important to provide a good experience to the end users (the students). In this paper, an investigation is being carried out as to why learners are dropping out courses few weeks after joining. Where to improve and how to offer them complete satisfaction.

Method

To understand the learner's satisfaction on different parameters. Hypothesis has been made on those assumed parameters. Then to accept or reject the hypothesis, survey and interview on the students has taken place. Author framed the questions based on assumed hypotheses, and it was asked during interviews and surveys.

Audience

Main audience are students and teachers, who are using e-learning tools in teaching and learning in colleges and schools.

Result

Data indicate that a learner's computer anxiety, instructor's attitude, lack of flexibility, low course quality, complexity in use and a lack of thorough assessment are critical factors associated with dissatisfaction among participants.

Critique

Investigator itself accepted the limitations of these findings, the survey was based on a single e-learning tool and few parameters were used to define the end user's need. Along with the self-assumed hypothesis, I would suggest further investigation should be done based on real time data obtained from user's interaction with e-learning tools using data analytics as a technical approach.

PAPER2

Veenita Shah, Sahana Murthy, Jayakrishnan Warriem, Sameer Sahasrabudhe, Gargi Banerjee, Sridhar Iyer. (2022): Learner-centric MOOC model: a pedagogical design model towards active learner participation and higher completion rates. Education Tech Research Dev (2022) 70:263–288. <https://doi.org/10.1007/s11423-022-10081-4>

Need

Quite like the above paper, this paper also investigates as to why initial MOOC / online platforms were not so effective in terms of learner's engagement and overall satisfaction. What enhancement can be brought into the existing system to make it more learner centric. Trend suggests that sooner or later, we will shift to hybrid or fully online mode of education. So, it will be very important that we explore the learner centered approach while developing such a system. With the same objectives, this paper is written.

Method

MOOC platform was developed using the LCM model (this model offers the framework to make MOOC learner centered, for example; discussion forums should be user friendly and infuse collaboration among students). Data source for this research came from MOOCs, it was categorized mainly in two categories: 1) completion rate 2) persistence rate. To address the research questions, along with quantitative data (obtained from MOOC interaction), qualitative data has been gathered using interviews and surveys of participants. Overall mixed method approach was implemented for this study.

Audience

Study was targeted to researchers and e-learning platform developers. These are the people who will analyze the learner's data and suggest future requirements to reiterate the system development process.

Result

According to data obtained from participants' activities, the improved learner centered MOOC completion rate moved significantly higher. In learning dialogue and focused discussion (part of LCM framework) similar gain was observed. Overall LCM was found to engage participants.

Critique

Researchers have done a great job in defining the LCM model, which may open the way forward to design learner centered MOOC. Learning activities are well structured with short videos and reflection spots in between. But we can improve the assessment part by integrating subjective and essay questions. Short, formative assessments do not always reflect the internal thinking process of learners.

PAPER3

Sonya E. Van Nuland, Elissa Hall, Natalie R. Langley (2020). STEM crisis teaching: curriculum design with e-learning tools.

<https://pubmed.ncbi.nlm.nih.gov/33205004/>

Need

As I already said in the first paper section, it would be great help if researchers can identify the correct set of tools and instructional strategies for different contexts and subjects. It will make classroom teachers' jobs more effective as they will be able to put more focus on their teaching contents. This study explores some key principles to consider when selecting e-learning tools into the curriculum.

Method

Based on past research in this domain, the author has put three broad questions, to help educators select and integrate an e-learning tool that complements the curriculum and address learner's need. To satisfy those questions, only common understanding from past research has been considered as a base, no qualitative or quantitative studies have taken place.

Audience

Looking at the message derived from study, the main audience seems to be educators, who will finally decide what e-learning tools to consider when designing instruction. At the same time, learners should be viewed as a second important audience since we need learner's data to understand if the system is working well.

Result

No comparative study has taken place so we can not come to any conclusion but if we go by backward design framework (given in the paper), we will be in better shape to select appropriate e-learning tools at the basic level.

Critique

We have just started our journey towards e-learning so it may not be sufficient to base our studies on the past research only, it would be very limited in usability. We must use data analytics on a broad range of e-learning tools and get insight on new advancement. Large scale study on e-learning tools and curriculum content is required to achieve some advisable evidence for teachers.

PAPER4

T.J. Kennedy, M.R.L. Odell (2014): Engaging Students in STEM Education: Science Education International Vol. 25, Issue 3, 2014, 246-258.
<https://files.eric.ed.gov/fulltext/EJ1044508.pdf>

Need

Worldwide it is acknowledged that knowledge society is the demand of the future and it will be supported well by the STEM field, which is supposed to carry most of the burden in preparing a suitable workforce. Having this thought author explores different types of STEM initiatives for school and college students. Objective of these initiatives is to develop real world practical knowledge in STEM. In this paper, focus has been kept on T-STEM, an initiative by TEXAS state in the USA.

Method

Author is not directly involved in any kind of qualitative or quantitative studies here. Instead, the author brings some statistics from various organizations where

T-STEM is in operation. Stats show that student's performance has improved on various STEM parameters after using these frameworks.

Audience

Educators and researchers who are involved in STEM curriculum development and teaching process are the main audience of this study. They can explore more on each initiative and it must help them formulate their teaching activities.

Result

Following points can summarize the effectiveness of T-STEM frameworks:

9th grade T-STEM students have higher chances of passing Algebra-I than peers in comparison schools.

Schools implementing the T-STEM academy blueprint saw significant drops in referrals for inappropriate behavior.

All these points summarize that it has sound potential towards students' achievements.

Critique

Until now what I understood from T-STEM, it is very much focused on STEM enrollment and career readiness. I did not find much about the pedagogical framework that is in use and how it helps in subject preparation. However, the result shows the benefits in terms of subject learning outcome. Further reading is required.

PAPER5

Isha Decoito, Mohammed Estaiteyeh (2022). Online teaching during the COVID-19 pandemic: exploring science/STEM teachers' curriculum and

assessment practices in Canada. *Disciplinary and Interdisciplinary Science Education Research* (2022) 4:8. <https://doi.org/10.1186/s43031-022-00048-z>

Need

This paper explores the online teaching and learning experiences in Canada during COVID-19. Canada is an internationally recognized country for its high-quality education and education reform at school level. So, such studies offer great insight as to how effective the online platform is and what is needed to improve the learning process.

Method

This study utilizes a mix method design to address research questions. Quantitative and qualitative data were collected from teachers through an online questionnaire. Objective was to obtain both comprehensive quantitative and rich qualitative data detailing teacher's experiences with online teaching.

Audience

Audiences are researchers and teachers who need experience and evidence of online teaching programs. Paper might help practitioners the way forward.

Result

Results indicate that many teachers have negative feelings with respect to curriculum delivery on online platforms. They complain about lack of collaboration among students, difficulty in aligning learner centered pedagogy to online platforms. They found assessment techniques (online questionnaire) were not very effective as compared to classroom methods.

Critique

This paper talks about lack of peer discussion, active learning support, lab simulation in STEM subjects as the main problems with online platforms. However, in recent years there have been great advances on these parameters. If I take the example of Canvas, they have improved on every measure mentioned above. We have come a long way and probably we need to embrace AI, Virtual reality and augmented reality into e-learning tools to enhance the overall system one step closer to having a human-like interaction with machines.

REFERENCES

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