



Challenges and Prospects of Virtual Method of Learning Mathematics: Analysis of Satisfaction and Needs Amongst Students of Tertiary Institutions in Kano State.

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ABSTRACT

The research delved into an examination of the challenges and potential opportunities associated with virtual mathematics learning, focusing on the analysis of student satisfaction and their specific requirements within the tertiary education institutions of Kano State. The study established three primary objectives and formulated three corresponding research inquiries to guide its investigation. Employing an ex-post-facto research design, the research employed a comprehensive questionnaire as its primary data collection tool, consisting of four distinct sections: demographic information (1 – 5), student satisfaction with virtual learning (6 – 12), pre-and post-virtual learning assessments (13 – 20), and student needs regarding virtual lessons. The research population encompassed all tertiary institution students in Kano State, from which a representative sample of two hundred and fifty students was selected using a combination of stratified and simple random sampling methods. Data analysis was conducted using SPSS version 20, with descriptive statistics, particularly frequency and percentage, serving as the primary analytical tools. The findings of the study unveiled several critical insights, including the inadequacy of virtual mathematics instruction for effective teaching and learning. Notably, student dissatisfaction stemmed from inadequate teacher preparation, resulting in suboptimal learning experiences. Furthermore, there was a noticeable neglect of addressing the specific needs of learners both before and after virtual learning sessions. In light of these findings, the study puts forth several recommendations. Firstly, it suggests that virtual learning methods must be meticulously organized and rendered attractive to engage students effectively, while simultaneously providing clear guidance on the essential prerequisites. Secondly, measures must be taken to ensure consistent and stable network connectivity to minimize disruptions during virtual lessons. Additionally, the timing of virtual lessons should be optimized to create a conducive learning environment for students. Lastly, the study underscores the importance of replicating the research to examine potential variations in individual gender responses to the virtual learning method.

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INTRODUCTION

Learning involves changes in behavior and the manifestation of new behavior ensures

acquisition of new knowledge. Learning of mathematics involves acquisition of new knowledge of concepts, principles, skills and

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generalization. Mathematics knowledge facilitates the smooth comprehension of scientific ideas, skills, and skills application in other aspects of human quest for knowledge, as such, opens the door to other fields of sciences and technology. Learning mathematics requires interaction between the teachers, contents to be learnt/taught and the learners during the teaching and learning situations.

The role of teachers is to properly disseminate the contents of learning through interactions with the students inside classrooms, in the laboratories, workshops and also in the open field. The activities done by the teachers at all levels are all geared towards leading the students to the proper acquisition of the knowledge meant in the contents to be taught. The procedures adopted by teachers are mostly using a face-to-face approach inside classrooms or any designated place meant for the lessons. Teachers made use of reference materials, instructional materials, gestures, chalk-talk, and demonstration all in the name of teaching.

Teaching mathematics requires that the teachers must be ready for the task ahead and by extension must have both the content and pedagogical knowledge plus enabling certification. The National Council of Teachers of Mathematics advocated in principles to action eight equitable and effective mathematics teaching practices regardless of whether instruction is in-person, remote, or hybrid as follows:-

1. Establish mathematical goals to focus learning.
2. Implement tasks that promote reasoning and problem solving.
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. Elicit and use evidence of student thinking.

On the other hand, the events of late 2019 led to paradigm shift in teaching and

learning. The outbreak of global pandemic called Covid-19 pushed everything everywhere backward including schools. The pandemic as evident globally necessitated the closure of every aspect of human endeavors. (Xiao, 2021) states that the Covid-19 has destroyed every sector of society including education; millions and millions of students have been affected (The United Nations, 2020). In addition, (Xiao, 2021) observes that even today, not all educational institutions around the world can return to 'normal' campus life.

The closure of all educational institutions necessitated the need to do something to reach out to the students while at home. According to (Bozkurt and Sharma, 2020); (Bozkurt et-al, 2020) and (Hodges et-al, 2020) with closure of educational institutions at every level nearly the whole world shifted to online emergency remote education (ERE). In his words Zimmermann (2020) says that this shift has been designated as the greatest online experiment. The ERE in itself is a mandatory survival mode of education implemented in times of crisis using all the resources available including offline and/or online tools (Bozkurt et-al, 2020). On the contrary however, (Xiao, 2021) posited that during the pandemic crisis online education might be the only or last resort in many circumstances although it was perhaps not for all.

Virtual or online learning is the modality of learning contents remotely through the use of computers or smartphones. It is a new means of teaching/learning method that enables learners to learn away from classroom and/or school. To learn through virtual method, the learner must be ready with computer/smartphone (fully charged) or stable power supply, functioning wireless fidelity (Wi-Fi), available data, reliable network connectivity and free time. Virtual learning approach provides learners with the opportunity to continue learning while at home. The procedures as identified by McGovern (2004) requires that the learners to have certain level of computer skills and that online course permit asynchronous learning rather than requiring students to be in a classroom at a given time and place.

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In a survey of online instruction, Teaching (2010) found that one of the main difference in instructional methods was that the online depend so much on text; is students centered (Sipes and Ricciardi, 2006); the process changes the instructor's role to that of facilitator and creates a challenge to keeping the learning active (Turball, 2002). In another studies (Kishore et-al, 2009) Kirtman (2009) and Larson & Sung (2009) found that face-to-face method of instruction was favoured by the students. Carle (2009), Cragg, Dunning & Ellis (2008) found no significant differences in the two methods of instruction while Singh and Stoloff (2007) reported that students believed they learnt as much in an online course as they did in a face-t-face class. In a different study, (Tutty and Klein, 2008) found that both online and face-to-face collaboration can lead to the development of effective learning strategies.

Virtual or online learning being a new method of educational content delivery needs to be prepared very well. In the latest studies on virtual learning (Zhu & Chen, 2020) maintained that to implement this learning process, electronic equipment is required; various technological equipment and digital resources are required (Alhassan, 2020; Shakah, Al-Oqaily & Alqudah, 2019). When the equipment needed are not readily available, then (Zhou, Zhao & Zhang, 2020) opined that e-learning is postulated as a challenge, not only for the members of the educational community; but also for the general public and not only because of the technological requirements that are needed, but also because of the level of digital competence needed to be able to carry it out effectively (Aghababaeir & Ardani, 2018).

There are many challenges to overcome while implementing E-learning in universities. Sekakubo, Suleman, and Marsden, (2011) point out the majority of E-learning initiatives implemented in some countries tend to fail while partially or entirely due to the various barriers to E-learning in developing countries. There is need for proper preparations before practicing the virtual learning approach. To implement the virtual learning process, electronic equipment is needed

(Zhu and Chen, 2020); various technological equipment and digital resources are needed (Alhassan, 2020); Shakah, Al Oqaily and Alqudah, 2019). When the needed equipment are not available, then e-learning cannot be done. Conversely, the use of e-learning is postulated as a challenge not only for the members of educational community but also for the general public (Zhou, Zhao and Zhung, 2020); and not only because of the technological equipment that are needed, but for also because of the level of digital competence needed to be able to carry it out effectively (Abhababacor and Andani, 2018).

Objectives of the study

The objectives of the study are to find out the:-

- 1 Level of satisfaction of the learners on virtual learning of mathematics
- 2 Whether the learners are being assessed before and after e-learning
- 3 Identify the learners needs on the virtual learning

Research Question

The study formulated the following research questions to guide the conduct of the study.

- 1 Are the learners satisfied with the virtual approach to learning mathematics?
- 2 To what extent are the leaners assessed before and after e-learning?
- 3 What do the learners need on the virtual learning?

METHODOLOGY

The Research Design adopted for the study was a survey design of ex post facto type. The research instrument used for the study was a questionnaire adopted from Sunkara and Kurra (2017) and adapted to suit the needs of the present study. The instrument consists of four parts, the demographic data (1 – 5), Learners Satisfaction of Virtual Learning (6 – 12), Learners Assessment before and After Virtual Learning Lesson (13 – 20) and the learners Needs on Virtual Lessons. The guide to filling the questionnaire was fully explained to the respondents prior to filling the responses.

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The population of the study consisted of all the students of tertiary institutions in Kano state. The sample of the study consisted of three hundred (300) students selected randomly from across the various tertiary institution. The study adopted a stratified sampling technique to select between the male and the female sample and a simple random sampling technique to select from the whole sample. The selection process involves selecting students that comes the way of the researcher during the course of data collection.

The data for the study were collected through the administration of questionnaires in

which three hundred were distributed but only two hundred and fifty were filled and returned and were analysed using SPSS version 20 specifically descriptive statistics using frequency and percentages.

DATA PRESENTATION

The study made use of the two hundred and fifty (250) filled and returned questionnaires for the analysis. The data collected from the research instruments were presented in tables 1–7 as follows:-

Demographic Data

Table 1: Distribution of Respondents by Age

| Age (Years) | No. of Students | Percentage of Total |
|--------------|-----------------|---------------------|
| 18 - 21 | 64 | 26 |
| 22 - 25 | 65 | 26 |
| 26 - 30 | 59 | 24 |
| Above 30 | 62 | 25 |
| Total | 250 | 100 |

From Table 1, respondents of 18 – 21 years are 64 (26%), 22 – 25 are 65 (26%), 26 – 30 are 59 (24%) and above 30 are 62 (25%). From the analysis, respondents of 18 – 21 and 22 – 25

years have the highest frequencies 64 (26%) and percentages 65 (26%) and the smallest frequency 59 (24%).

Table 2: Distribution of Respondents by Gender

| Gender | No. of Students | Percentage of Total |
|--------------|-----------------|---------------------|
| Male | 120 | 48 |
| Female | 130 | 52 |
| Total | 250 | 100 |

From Table 2, of the 250 respondents, male were 120 (48%) while the female respondents were 130 (52%). The analysis shows

that the female respondents were more than the male respondents by ten (10).

Table 3: Distribution of Respondents by Location

| Location | No. of Students | Percentage of Total |
|--------------|-----------------|---------------------|
| Urban | 171 | 68 |
| Rural | 79 | 32 |
| Total | 250 | 100 |

From Table 3, of the 250 respondents, 171 (68%) were from the urban areas, while 79

(32%) were from the rural areas. This happening is the further indication and confirmation of the fact

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that urban areas have upper hand in terms of educational opportunities.

Table 4: Distribution of Respondents by Level of Study

| Leve of Study | No. of Students | Percentage of Total |
|---------------|-----------------|---------------------|
| Undergraduate | 63 | 25.2 |
| IJMB | 105 | 42.0 |
| Diploma | 41 | 16.4 |
| NCE | 41 | 16.4 |
| Total | 250 | 100 |

From Table 4, 63 (25.2%) are undergraduate students, 105 (42.0%) are IJMB students and 41 (16.4%) each are both Diploma and NCE students. The highest number of students in a program is 105 for IJMB. With the distribution, majority of the students are pursuing IJMB rigorously to prepare themselves very well for the university studies. The least number of students is 41 for those pursuing Diploma and NCE certificates.

THE RESULT

The analyses of the collected data from the research instruments were presented in Table 5-7

Research Question One: Are the learners satisfied with the virtual approach to learning mathematics?

The required data needed to answer research question one can be found in Table 5.

Table 5: Learners Satisfaction of Virtual Learning of Mathematics

| QN | Question | Responses | | | | | | | | | |
|----|--|-----------|---|----|----|-----|----|-----|----|-----|----|
| | | A | % | O | % | S | % | R | % | N | % |
| 6 | Were you able to use the technology and internet including web browsing for your learning with ease? | 23 | 9 | 41 | 16 | 87 | 35 | 81 | 32 | 18 | 7 |
| 7 | Was the e-learning system used by you useful to fulfil your learning needs? | 0 | 0 | 0 | 0 | 128 | 64 | 0 | 0 | 58 | 32 |
| 8 | Was the e-learning system used by you organized to satisfy your learning objectives? | 0 | 0 | 0 | 0 | 100 | 40 | 104 | 42 | 45 | 18 |
| 9 | Was it easy for you to understand the features of the e-learning system or LMS that you have used? | 0 | 0 | 0 | 0 | 22 | 8 | 59 | 24 | 169 | 68 |
| 10 | Was the e-learning system used by you providing you with the precise course content that you are looking for? | 0 | 0 | 0 | 0 | 24 | 10 | 191 | 76 | 35 | 14 |
| 11 | Was the e-learning system used by you providing you with flexibility to navigate among learning resources to control your individual learning speed? | 0 | 0 | 0 | 0 | 209 | 84 | 41 | 16 | 0 | 0 |
| 12 | Was the design and user interface of the e-learning system used by you attractive and customizable? | 0 | 0 | 89 | 34 | 17 | 7 | 121 | 48 | 23 | 11 |

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From Table 5, the responses 'Sometimes', 'Rarely' and 'Never' have the highest frequencies. In QN6, the ability to use technology and internet including browsing for personal learning was asked. The responses therefrom were 23 (9%) for Always, 41 (16%) for Often, 87 (35%) for Sometimes, 81 (32%) for rarely and 18 (7%) for Never. Despite the frequent use of smartphones by the learners only 23 (9%) and 41 (18%) learners use the internet for learning with ease. QN7 – QN12 all have a centrally clustered responses of 'Sometimes' plus other responses of 'Rarely' and 'Never'. This situation explains that the learners are not satisfied with the virtual learning approach of learning mathematics. The learning approach was not useful, organized, flexible, attractive/customizable and has no provision for precise content.

The responses 'Always' and 'Often' can be termed as having a relatively positive

connotation in terms of acceptability/agreement with the statement or question given. On the contrary, the response 'Sometimes' can be considered as neutrality with respect to the statement/question while 'Rarely' and 'Never' connote negativity and disagreement. In view of this, only Q6 and Q12 have responses with a slightly 64 and 89 (put together) responses in terms of satisfaction. The conclusion is that, the learners are not satisfied with the virtual learning approach of learning mathematics. The learning approach was by way of the responses not useful, organized, flexible, attractive/customizable and has no provision for precise content.

Research Question Two: To what extent are the learners assessed before and after e-learning?

The answer to the research question can be deduced from the discussion under Table 6.

Table 6: Learners Assessment before and After Virtual Learning Lesson

| QN | Question | Responses | | | | | | | | | |
|----|---|-----------|---|-----|----|-----|----|-----|----|-----|----|
| | | A | % | O | % | S | % | R | % | N | % |
| 13 | Have you ever been assessed on your learning objectives before the start of an e-learning course? | 0 | 0 | 0 | 0 | 150 | 60 | 41 | 16 | 59 | 24 |
| 14 | Have you ever been assessed on your personal learning needs and context before the start of an e-learning course? | 0 | 0 | 22 | 9 | 82 | 33 | 146 | 58 | 0 | 0 |
| 15 | Have you ever been questioned on your personal learning preferences before the start of an e-learning course? | 0 | 0 | 0 | 0 | 99 | 40 | 128 | 51 | 23 | 9 |
| 16 | Have you ever been questioned on your personal learning habits before the start of an e-learning course? | 0 | 0 | 106 | 42 | 63 | 25 | 58 | 23 | 3 | 1 |
| 17 | Have you ever been questioned on your preferred teaching styles before the start of an e-learning course? | 0 | 0 | 24 | 10 | 169 | 68 | 17 | 7 | 40 | 16 |
| 18 | Have you ever been assessed on your personal online learning skills and abilities before the start of an e-learning course? | 0 | 0 | 45 | 18 | 17 | 7 | 188 | 75 | 0 | 0 |
| 19 | Have you ever been assessed on your prior knowledge required to learn the course before the start of an e-learning course? | 0 | 0 | 0 | 0 | 109 | 44 | 35 | 14 | 106 | 42 |

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From Table 6, QN14, 16, 17 and 18 have 22 (9%), 106 (42%), 24 (10%) and 45 (18%) responses relative to positive outcome. The response 'Sometimes' signifying neutrality has the highest frequency in Q13, 17 and 19 with 150 (60%), 169 (68%) and 109 (44%) responses respectively.

From Table 6, learners have not been assessed on learning objectives, on personal learning needs, on personal learning preferences and not assessed on prior knowledge before and

after start of the e-learning. In a summary, the learners are not being assessed on the learning objectives, on personal learning needs and preferences, on online learning skills and on prior knowledge required. The learners were only questioned on personal learning habits.

Research Question Three: What are the needs of the learners on the virtual learning?
The required data to answer research question three is contained in Table 7.

Table 7: Learners Needs on Virtual Lessons

| QN | Question | Responses | | | | | | | | | |
|----|---|-----------|----|-----|----|---|---|---|---|---|---|
| | | A | % | O | % | S | % | R | % | N | % |
| 20 | How likely you will be able to provide your learning objectives and context during the selection of personalized e-learning course? | 124 | 49 | 126 | 51 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | Will you be able to choose your preferred teaching/pedagogical preferences for an e-learning course? | 145 | 58 | 105 | 42 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | Will you be able to specify your personal learning preferences on an e-learning course so as to customize your learning experience? | 140 | 56 | 110 | 44 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | How frequently will you need moderator/peer assistance to select your personal learning choices for an e-learning course? | 81 | 32 | 169 | 68 | 0 | 0 | 0 | 0 | 0 | 0 |

From Table 7, the learners responses were almost having a relative positive connotation as the responses were all 'Always' and 'Often'. The needs with the highest response of 'Always' are the need to choose preferred teaching/pedagogical preference 145 (58%) and the need to specify personal learning preference to customize learning experience 140 (56%). The need with highest 'Often' response are the need to provide learning objective 126 (51%) and the need for a moderator/peer assistance to select personal course.

In a summary, the learners need to be provided with personal learning objectives, to choose a teaching preference, to customize learning experience and need for a moderator/peer assistance for them to attain the full or new full level of comprehension of the contents taught.

The learners require some essentials and guides on how to go about the virtual learning notably need for learning objectives, preferred teaching preference, specify personal learning preference, need for a moderator or peer assistance and the skills needed to handle the virtual learning. The discussion under Table 7 provides answer to research question three which include the need for provision of personal learning objectives, to choose a teaching preference, to customize learning experience and need for a moderator/peer assistance

SUMMARY OF FINDINGS

The study investigated the challenges and prospects of virtual method of learning mathematics: Analysis of Satisfaction and Needs Amongst Students of Tertiary Institutions in Kano State. To guide the conduct of the study three

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research questions were formulated and answered. The study found that:-

- i) The learners were not satisfied with the virtual learning approach as it is more textual and no interactions.
- ii) The virtual approach of learning mathematics does not recognize learners' assessment on prior knowledge, online learning and internet browsing skills and the learning preferences before and after the virtual learning lessons.
- iii) The learners' needs were not taken care of as the approach recognizes texts than practical and active participation.

DISCUSSION

The study investigated the challenges and prospects of virtual method of learning mathematics: Analysis of Satisfaction and Needs Amongst Students of Tertiary Institutions in Kano State. To give direction to the study, three objectives and three research questions were formulated. The study adopted a survey design and utilized an adopted and adapted research instrument developed by Sunkara and Kurra (2017). The study found that despite the prevailing circumstances surrounding the adoption of virtual approach to almost all important gatherings, the approach is not satisfactorily relevant to learning mathematics. This is due to the fact that the approach is central to text as reported by (Teaching, 2010) who found that the instructional method (online) depend so much on text. The findings also support the earlier work of (Xiao, 2021) who posited that during the pandemic crisis online education might be the only last resort in many circumstances although it was perhaps not fir for all. Similarly, the works of (Kishore et-al, 2009), (Kirtman, 2009) and Larson & Sung (2009) who found that face-to-face method of instruction was favoured by the students, supports the present study.

The online activities of students if were geared towards studies, the performance will be improved greatly. There is no disputing the fact that almost all student have an android/smartphone with which they ought to be browsing relevant materials online using any of the search engines particularly google or Ask.com.

Unfortunately, the android/smartphones were used mainly for chatting or having fun on social media platforms mainly WhatsApp, Instagram, Facebook and/or twitter handles.

CONCLUSION

Sequel to the discussion of all the tables and the findings therefrom, the study concluded that virtual learning of mathematics is not for all, as learners' needs and assessments, being essential if not well catered for, the end result will not be good to arrive at.

Recommendation

The study subsequent upon the conclusion that virtual learning of mathematics is not fit for all, recommends that:-

1. The learning method must be well organized and made attractive
2. Students need be sensitized on what are necessarily needed
3. Adequate arrangement must be made to ensure stable network connectivity
4. The time for the lesson to be made conducive to the learners
5. The study need be replicated to ascertain the individual gender response on the virtual learning method.

REFERENCES

- Aghababaei, M., & Ardani, S. (2018). Trend of Changes in E-learning Role in Identity Changes, Achievement Emotions and Attitude towards School between High School Students from Smart and Traditional Schools. *Mod. J. Lang. Teach. Methods*, 8(10), 570–586
- Alhassan, R.K. (2020). Assessing the preparedness and feasibility of an e-learning pilot project for university level health trainees in Ghana: a cross-sectional descriptive survey. *BMC Medical Education*, 20, 1-10. Doi: 10.1186/s12909-020-02380-2
- Bozkurt, A., & Sharma, R. C. (2020). Education in normal, new normal, and next normal: Observations from the past, insights from the present and projections for the

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- future. *Asian Journal of Distance Education*, 15(2), i-x.
<https://doi.org/10.5281/zenodo.4362664>
- Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G. Paskevicius, M. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, 15(1), 1–126.
<https://doi.org/10.5281/zenodo.3878572>
- Carle, A. C. (2009). Evaluating College Students' Evaluations of a Professor's Teaching Effectiveness across Time and Instruction Mode (Online vs. Face-to-Face) Using a Multilevel Growth Modeling Approach. *Computers & Education*. 53(2), 429-435
- Cragg, C. E., Dunning, J., & Ellis, J. (2008). Teacher and Student Behaviors in Face-to-Face and Online Courses: Dealing with Complex Concepts. *Journal of Distance Education*. 22(3), 115-128.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020, March 27). The difference between emergency remote teaching and online learning. *EDUCAUSE Review*.
<https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Kirtman, L. (2009). Online versus In-Class Courses: An Examination of Differences in Learning Outcomes. *Issues in Teacher Education*. 18(2), 103-116
- Kishore, M., Tabrizi, M. H. N., Ozan, E., Aziz, S., and Wuensch, K. L. (2009). Correlates of Student Preference for Online Instruction over Face-to-Face Instruction. *E-Learning*. 6(4), 400-415
- Larson, D. K., and Sung, C.-H. (2009). Comparing Student Performance: Online versus Blended versus Face-to-Face. *Journal of Asynchronous Learning Networks*. 13(1), 31-42.
- McGovern, G. (2004, June). Teaching Online vs. Face-to-Face. [Electronic version]. *CLENExchange*, Newsletter of American Library Association Continuing Education Network & Exchange Roundtable. Vol. 20 No. 4.
- NCTM (2018). *Catalyzing Change in High School Mathematics: Initiating Critical Conversations*. Reston, VA: NCTM.
- Shakah, G., Al-Oqaily, & Alqudah, F. (2019). Motivation Path between the Difficulties and Attitudes of Using the E-Learning Systems in the Jordanian Universities: Ajloun University as a Case Study. *Int. J. Emerg. Technol. Learn.*, 14(19), 26–48
- Singh D., & Stoloff, D. (2007). Effectiveness of Online Instruction: Perceptions of Pre-Service Teachers. *International Journal of Technology, Knowledge & Society* v2 n6 p121-124
- Sipes, K. A. and Ricciardi, V. (2006) Online vs. Face to Face: Is There a Difference in How Accounting and Finance Students Learn in an Online vs. Face-to-Face Setting. SSRN. Retrieved September 9, 2010 from <http://ssrn.com/abstract=894223>
- Ssekakubo, G., Suleman, H., & Marsden, G. (2011). Issues of adoption: Have e-learning management systems fulfilled their potential in developing countries? In *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment* (pp. 231–238). Cape Town, South Africa.
- Sunkara, V. M. and Kurra, R. R. (2017) An Analysis of Learner Satisfaction and Needs on E-Learning Systems. *International Journal of Computational Intelligence Research* ISSN 0973-1873, 13 (3), pp. 433-444

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- Tutty, J. I., & Klein, J. D. (2008). Computer-Mediated Instruction: A Comparison of Online and Face-to-Face Collaboration. *Educational Technology Research and Development*, 56(2), 101-124.
- Xiao, J. (2021). Decoding new normal in education for the post-COVID-19 world: Beyond the digital solution. *Asian Journal of Distance Education*, 16(1), 141-155.
<https://doi.org/10.5281/zenodo.4818369>
- Zhou, Y.Z., Zhao, J., & Zhang, J.J. (2020). Prediction of learners' dropout in E-learning based on the unusual behaviors. *Interactive Learning Environments*, 1-25. Doi: 10.1080/10494820.2020.1857788
- Zhu, X., & Chen, Z. (2020). Dual-modality spatiotemporal feature learning for spontaneous facial expression recognition in e-learning using hybrid deep neural network. *Vis. Comput.*, 36, 743–755. Doi: 10.1007/s00371-019-01660-3
- Zimmerman, J. (2020). Coronavirus and the Great Online-Learning Experiment. *Chronicle of Higher Education*.
<https://www.chronicle.com/article/Coronavirus-the-Great/248216>

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