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Science Teachers' Attitude regarding Use of Digital Tools in Public School of Punjab

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Abstract

Science teachers in many countries use Digital tools (DTs) less frequently, despite the increasing potential of DTs for teaching and learning. The attitude of science teachers toward DTs and their perceptions of DTs' use in the classroom has a significant effect on their use of ICT in their learning and teaching activities. The main objective of this study was to develop an understanding of how science teachers have attitudes regarding the use of DTs in the science classroom. The paradigm of this research was interpretive and the research method was qualitative. Convenience sampling was utilized to explore science teachers' attitudes toward the use of DTs in public schools. This case study included ten science teachers for individual interviews. In this research, an accessible data source NVivo software was used for thematic analysis to classify, establish, and improve understanding of themes through the data collections. The "three science teachers' typology" was recognized after the interviews with the participants. The analysis indicated that a science teacher does not easily accept the change that occurs through technology. They would feel the influence and maybe experience acclimation problems. Because the personality trait of a teacher has a direct impact on a student's ability and performance. It is suggested that educational institutions set up teacher training programs to educate them on various cutting-edge strategies and procedures that might assist in developing a positive attitude toward DTs and integrating technology.

Keywords: Science teachers' typology, attitudes, digital tools

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Introduction

The teaching system has changed to meet the demands of the digital age (Alkhayat, Ernest, & LaChenaye, 2020). Science teachers have been introducing and using Digital Tools (DTs) in classrooms all over the world, making schools and DTs intimately connected (Castañeda, Esteve, & Adell, 2018). Many digital tools have been incorporated into schools in recent years (Roussinos & Jimoyiannis, 2019). These materials are defined as resources created for learning dedications, compiled digitally, and chosen by teachers to achieve a variety of goals, such as content transmission, facilitating the teaching moment, stirring up interactions, evolving learning skills, or making assessments (Alberola-Mulet et al., 2021). Information and Communications Technology (ICT) and Digital Tools (DTs) are established of well-known expertise that enables science teachers to accomplish and interrelate with knowledge and information (Tondeur et al., 2017).

Nowadays, science teachers are accountable for scheming the teaching-learning procedure, which includes not only transferring information but also developing learners' abilities and proficiencies through the use of DTs. They would be used as a tool for alteration, enabling learners to gain information through cooperative and credible teaching activities that allow exploration (Alberola-Mulet et al., 2021). Cooperation, communication, digital learning, participation, problem-solving, and inventive, innovative, and constructive thought are among the skills and competencies that are required in today's society (Nugroho & Mutiaraningrum, 2020).

In 2016, Area-Moreira et al. identified the following characteristics of DTs integration concepts for academic purposes: on the one hand, science teachers through specialized practice, who are regular users and sufficiently trained, and on the other hand, teachers who use old-style resources and familiarize technologies occasionally. As a result, new technologies' pedagogical potential has yet to blossom in the teaching process (Tondeur et al., 2017). Teachers continue to mix them with traditional materials, fail to utilize them (Alberola-Mulet et al., 2021), and are hesitant to include ICT and DTs in their classrooms (Hayak & Avidov-Ungar, 2020).

The attitude of science teachers toward DTs and their perceptions of DTs use in the classroom play a significant effect on their use of ICT in their learning and teaching activities (Froese-Germain, Riel, & McGahey, 2013). Teachers' negative attitudes toward technology are a major element in their resistance to incorporating information technologies into

education, despite the resources available in their schools and classrooms (Alkhayat, Ernest, & LaChenaye, 2020). They may view technology as intimidating and overwhelming (Roussinos & Jimoyiannis, 2019), or they may be afraid of appearing incompetent or ignorant in front of their students (Tondeur et al., 2017). This negative attitude may force teachers to mistrust the value of technology in the classroom and, as a result, be hesitant to employ it (Castaeda, Esteve, & Adell, 2018). Many attractive technological advancements have failed to deliver on their promises in the past due to neglect of halfway point attitudes and needs (Hayak & Avidov-Ungar, 2020).

In 2009, the Punjab province of Pakistan launched an ICT lab project in six districts to give DTs to public schools and encourage students and teachers to use them (Hasan & Sajid (2013), accompanied by research to define learners' views of the project's effectiveness. Although suitable provisions were delivered under this program to secondary schools, just those learners and teachers who were either studying or teaching computer or science subjects used them. Learners and teachers from different disciplines were also unable to use computers due to a lack of IT expertise.

It appears that science teachers are the ones who are most resistant to using technology (Froese-Germain, Riel, & McGahey, 2013). Not only are teachers averse to technology adoption, but other obstacles way as a shortage of hardware and software, teacher attitudes toward DTs, deficiency of confidence, and lack of competency all play a role in preventing effective integration (Tondeur et al., 2017). Al-Abri & Mydin (2021) conducted another study that looked at the direct and indirect impacts of DTs on academic achievement and teaching change in learning. After the literature review, the researcher did not find any study that shows the belongings of DTs' involvement in teachers' attitudes or performance. In light of the current context, it is vital to reconnoiter science teachers' attitudes toward the use of DTs.

Statement of the Problem

The opinion and attitudes of teachers about using DTs in learning and teaching have long been recognized as a significant criterion for the successful adoption of novel technologies in the discussion on ICT in schools. Research conducted by the International Association in 2013 for IEA (the Evaluation of Educational Achievement), shed light on teachers' views toward ICT and pretending that ideas of the instructional benefits of technology dissent. In light of this finding, the goal of this research was to identify any teacher typology who has different attitudes on the learning

potential of DTs.

Significance of Study

This study could be beneficial to both science teachers and students. The researcher anticipates that this study will help to understand more about science teachers' attitudes on the use of DTs and how to better administer them if necessary. Finally, this study considers future teachers and how they might effectively employ various types of DTs in the science classroom.

Objectives of the study

The research intended to explore the attitude and perceptions of Public schools' science teachers who teach science subjects (physic, chemistry & biology). The main objective was to develop an understanding of how they have attitudes regarding the use of DTs in the science classroom.

Research Questions

1: How do science teachers have attitudes toward the use of digital tools in science classrooms?
2: How do science teachers use digital tools to support the science curriculum?

Literature Review

The attitudes of science teachers regarding the use of DTs in education and teaching have traditionally been seen as an essential criterion for the fruitful deployment of new Digital tools (DTs) in the discussion on the incorporation of ICT into schools (Eickelmann & Vennemann, 2017). Science teachers in many countries use DTs less frequently (Al-Abri & Mydin (2021), despite the accumulative potential of DTs for teaching and education. Various research has revealed that in the majority of schools, the use of computers in the classroom is still considered a novelty (Froese-Germain, Riel, & McGahey, 2013). Their attitudes and views about the value of using DTs in educational settings are equally important for their effective utilization (Hayak & Avidov-Ungar, 2020).

For this reason, studies from various disciplines have observed into typologies and traits of science teachers that influence the usage of DTs in educational institutions. They were capable to reveal that there are

varieties of explanations for why few science teachers utilize DTs in their classrooms whereas others do not (Castañeda, Esteve, & Adell, 2018), accelerating the signification of characteristics between internal and external features that might be causing science teachers' usage of DTs in the schoolroom (Nugroho & Mutiaraningrum, 2020).

Over the past two decades, both quantitative and qualitative research has shown that internal and external factors may be performing as barriers (Froese-Germain, Riel, & McGahey, 2013; Lorenz et al., 2015). Deficiency of technology-based structure in schools (e.g., accession to computers, the Net, or certain computer software packages), time restraint (e.g., inadequate time accessible to prepare pedagogy through digital tools), and a deficiency of technological or pedagogic assistance are all examples of external hurdles (Castañeda et al., 2018; Alkhayat, Ernest, & LaChenaye, 2020). Teachers' intrinsic causes consider their attitudes around instruction and DTs, as well as teaching activity and their involuntariness to modify the learning process (Hayak & Avidov-Ungar, 2020).

As a consequence, it might be claimed that extraneous hurdles may be mitigated by devoting exceptional resources to educational institutions, such as providing sufficient software applications and computers or furnishing extra training for instructors. Intrinsic elements, such as strong affective attitudes, on the other hand, are more likely to persist throughout time (Castañeda et al., 2018; Alkhayat, Ernest, & LaChenaye, 2020). When it comes to growing the use of DTs, internal issues are significantly more difficult to alter. For the introduction and usage of DTs in schools to be successful, internal aspects relating to science teachers' attitudes are required (Tondeur et al., 2017). In a study conducted by Eickelmann & Vennemann (2017), Computer delight, computer rejection, usage of email, productiveness, and general impression of computers in the research were all lower among science teachers with a fundamental level of DTs acceptance. They identified themselves as having a greater fear of computers and a gloomy outlook on their impact. The instructors at the other point of the technology acceptance criterion (phase 6) systematically had "the higher mean scores in electronic computer activity, email, productiveness, and linguistics opinion of computers between the 6 phases of acceptance category groups." Additionally, across all the instructor groups, this group of teachers had the lowest levels of anxiousness, computer rejection, and a negative affectation toward the effect of ICT (Eickelmann & Vennemann, 2017).

Al-Hayat et al., 2020 presented a study lately that took a different method to recognize trends in teachers' thoughts and attitudes about DTs.

They were capable to distinguish four separate instructor groups based on their opinions. In terms of the usefulness of using DTs in learning and teaching, three of the four groups had reasonably favorable attitudes, and only one group had a negative affectation. The thought of this group was that using DTs in the classroom was "unnecessary" and threatened the teacher's authority.

As noted from the review of the above literature, the methodological approaches utilized to detect form in teachers' beliefs and attitudes toward adopting DTs in education settings have been restricted to the fundamental product. Furthermore, current research on trends in teacher attitudes and views is limited to science teachers' populations and lacks a broad perspective. In light of the current situation, it is critical to examine science teachers' attitudes on the use of DTs.

Methodology

Qualitative Research Design

This study employed a qualitative design and an interpretive paradigm. The emphasis of the interpretive paradigm is on taking into account and elucidating participant viewpoints on the topic being studied (Boyle, 2018). Especially, a qualitative research method is acceptable while the nature of research questions needs to explore (Hennink et al., 2020). An in-depth case study was chosen as the research design to examine the practices and difficulties associated with blended learning. The case study enables the collection of extensive data for specific information that is closely tied to reality and truth, thus providing "a natural basis for generalizations" (Yazan, 2015).

Sampling & Participants

Convenience sampling was utilized to explore science teachers' attitudes toward the use of DTs in public schools. This case study included ten science teachers for individual interviews.

Data Collection

The idea of data collection approaches denotes overall the suitable usage of methods for collecting the data and analysis (Boyle, 2018). The participants were informed through a consent letter about the study. The

participants replied to semi-structured interviews interrelated to the research questions. The main credible aim of this study was to use the interviews as a primary data source when "studying people's understanding of the meaning in their lived world," qualitative interviewing is appropriate" (Yazan, 2015). The one-to-one interview is repeatedly noticed as a communication between the interviewee and interviewer, through semi-structured the interviewer probes questions, and the interviewee replies (Hennink et al., 2020). The researcher also generated observation, and field notes instruments. For the review of the transcribed files of interviews, files were sent to the participant and then reverted to the researcher after the accomplishment of the member checking.

Data Analysis

Qualitative research consists of constant interaction between the collection of data and analysis of data (Boyle, 2018). In this research, an accessible data source, NVivo software was used for thematic analysis to classify, establish, and improve understandings of themes through the data collections.

Finding

The "three science teachers' typology" was recognized after the interviews with the participants. According to them when the digital tools were implemented in their schools' few teachers did not accept this because they did not want to change. Some teachers have partially accepted an e-learn project that was in the middle of the road, and most of the teachers accepted it openly, and they were also involved in different activities through technology.

The analysis indicated that a teacher does not easily accept the change that occurs through technology. They might experience the effects and maybe have acclimatization issues. Because a teacher's personality traits directly affect a student's ability and performance. If the instructors are inquisitive or retroactive, they will employ any technology that is accessible to them. Hence, the instructors requisite to be conscious of novel DTs, acquire them, and organically integrate them into their pedagogy method, accenting that the relation might be flexible because these programs are user-friendly.

Technophobia (closed Position)

Technophobia, often known as techno fear or closed position, is a fear of technology. According to the findings, some teachers were afraid of or disliked advanced technologies. One of the respondents stated that the digital tools were tough to handle and operate initially. Such as ST 4 expressed his concerns like that**:**

"In starting, few teachers thought that there should be no lecturers in the application, and it is difficult to operate these digital tools during the class lecture. If I teach through video, or PowerPoint then why my lecture is necessary. It is a style of distance learning, and it can facilitate the students at home. Because in school, there are qualified teachers and they don't need video lectures".

Few science teachers also shared that in the starting few teachers responded very immoral for this ICT and DTs because they felt the fear of the technology. As ST5 expressed,

"*When we started to use the technology in science classes, few teachers reacted how they can handle technology because they never used it before*".

One science teacher (ST 10) also mentioned that

"*whenever students had any difficulty understanding the topic or concept, I stopped the video and explained it to students. In that way, I ask the students if they have any queries or if they can't understand anything, then ask me. I think it is a waste of time*".

The analysis of the data revealed that few teachers initially expressed fear of technology during the DTs. The fact that they had never used it before led them to believe that the traditional method was more effective, which they had always used to teach their classes. It was the case, although there were fewer of these teachers.

In-between (No preparation/Middle of the road)

Being science teachers, some teachers partially accepted the DTs, they were in the middle of the road. The analysis exposed that at the beginning of the DTs use in science classrooms, teachers did not interest in video

lectures or projector use, but gradually when they used it, they changed their minds, but it took time. As ST9 responded like that,

"*At starting of the e-learn project, many teachers were not much interest in videos. They wanted to see videos of their preference*".

Similarly, ST 7 mentioned that the need for the DTs is based on the topic requirement, but for some lectures, I don't need it. He explained,

"*Digital tools are used where it is needed. For example, when I teach solar systems then I have to use a projector or computer. It is necessary to show the movement through the videos. When I teach the definition of mechanics, DTs are not necessary. Teachers should use it where it is necessary*".

Consequently, SST 3 supported the above statements,

"*In the starting, we use the computer and e-learn app for our understanding but not used in the classroom. In the classroom we were more focused to read the hard book"*.

Through the analysis, it was revealed that initially, teachers were hesitant to use DTs for their understanding but eventually came to appreciate their advantages.

Getting Involved (Open Position)

The analysis revealed that most of the teachers accepted the DTs openly, and they were also teaching in their classrooms through video lectures or PowerPoint lectures. Most science teachers explained that teaching through DTs is a good initiative from the government. Now we might easily be using video lectures and animations during the class.

Such as, SST1 expressed his view in that

"*yes, in such a topic we refer to the digital tools that are good facilitation by the Punjab government. The digital content covers explanations through video lectures for each topic. For instance, if my lecture is not enough to explain the concept, I use videos to get the concept across*".

However, SST 6 also pointed similar that

"*Computer or DTs are often used when the questions are intricate, or a topic whose theory information is not enough. Sometimes, if I'm not sure of something, then I search it out and introduce it to the kids as well. I also use technology when there is something mentioned in the book that I don't know about it. In that case, as well, searching comes in handy*".

Through the interviews, most science teachers expressed their opinions about the benefits of the DTs and teaching DTs. According to the participants, no doubt it's beneficial for both students and teachers.

SST8 shared his thought with an example,

"*It is very useful for students as well as for teachers. For example, in physics class, I had to explain the Pascal law. It would be highly difficult for me to draw figures of the car brake system on board. It's quite challenging for me to draw pictures. Through DTs, videos and animations can display on the screen and students can view them easily. There is no need to explain or draw the pictures on board"*.

Those science teachers who acceptable well and affectionately the DTs, are desirable to practice in their classroom via DTs. In their opinion, teaching through computer or DTs facility to guide their student without difficulty.

Discussion & Conclusion

The researcher chose a case study research approach to explore scientific teachers' attitudes toward the use of DTs for learning and teaching in public schools in Punjab, and a semi-structured interview was utilized to ask questions of ten school science teachers. The "three science teachers' typology" was recognized after the interviews with the participants. According to them when the digital tools were implemented in their schools' few teachers did not accept this because they did not want to change. Some teachers have partially accepted an e-learn project that was in the middle of the road, and most of the teachers accepted it openly, and they were also involved in different activities through technology.

The participants believed that a teacher who was not born during the technological era of knowledge would feel the effects and may have a difficult time adjusting. Because the personality attribute of the teachers

have a straightforward effect on a student's knowledge to change. Researchers from various disciplines have looked into typologies and traits of science teachers that influence the usage of DTs in educational institutions. They were capable to establish that there were varieties of reasons why some science teachers utilize DTs in their classrooms while another do not (Castañeda, Esteve, & Adell, 2018).

The analysis of data also revealed that at starting of the DTs, just a little amount of teachers felt fear of technology. This group thought that using DTs in the classroom was "unnecessary" and threatened the teacher's authority (Alkhayat et al., 2020). Since they've never utilized it before and they had always taught their classes using the traditional technique, they believed that it was the best. It was the reality, but the number of these teachers was less. The result of this study is supported by a study conducted by Eickelmann & Vennemann (2017), they described themselves as being more fearful of computers and more pessimistic about the impact of computers. The science teachers at the other extreme of the technology acceptance criterion (phase 6) systematically had "the higher mean scores in electronic computer activity, email, productiveness, and linguistics opinion of computers between the 6 phases of acceptance category groups." Additionally, across all the instructor groups, this group of teachers had the lowest levels of anxiousness, computer rejection, and a negative affectation toward the effect of ICT (Eickelmann & Vennemann, 2017).

The finding of the study was also reconnoitered that initially, teachers were hesitant to use DTs for their understanding but eventually came to appreciate their advantages. Teachers continue to mix them in with traditional materials, fail to utilize them (Alberola-Mulet et al., 2021), and are hesitant to include ICT and DTs in their classrooms (Hayak & Avidov-Ungar, 2020).

Those science teachers who accepted easily and affectionately the DTs, preferred to practice in their classroom through DTs. In their opinion, teaching through computer or DTs facility to guide their student without difficulty. They should be used as a tool for transformation, enabling learners to gain knowledge through cooperative and credible learning activities that allow exploration (Alberola-Mulet et al., 2021). If the science teachers are inquisitive or retroactive, they will employ any technology that is accessible to them. Hence, the instructors requisite to be conscious of novel DTs, acquire them, and organically integrate them into their pedagogy method, accenting that the relation might be flexible because these programs are user-friendly. By DTs, the education structure converts additional elastic and user-friendly (Eickelmann & Vennemann,

2017).

Recommendations

Although the results of the analyses given are intriguing, it is recognized that methodological constraints and future studies must be addressed and debated. The study's sample, which included only science teachers from secondary schools in Lahore, was one restriction on which the conclusions were founded. The findings are limited in generalizability due to the study's geographical limitation. As a result, further research with bigger and more diverse samples across the country is suggested.

Therefore, it is also suggested that educational institutions set up teacher training programs to educate them on various cutting-edge strategies and procedures that might assist in developing a positive attitude toward DTs and integrating technology. As new technologies develop, these training programs must be updated, eliminated, or changed.

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