Investigating the impact of digital dialogue on conceptual learning of high school science students

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Approval

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Dedication

I would like to dedicate this thesis to my mother who was always there for me, for her kindness and devotion and who has been my source of inspiration and gave me strength. Although she is no longer of this world, her memory continues to regulate my life, and I will make sure your memory lives on as long as I shall live.

Certificate of Originality

I hereby declare that the research titled "***Investigating the impact of digital dialogue on conceptual learning of high school science students***" is my own work to the best of my knowledge. It contains no materials previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any degree or diploma at SEECS, NUST or any other education institute, except where due acknowledgment, is made in the thesis. Any contribution made to the research by others, with whom I have worked at SEECS, NUST or elsewhere, is explicitly acknowledged in the thesis.

I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic is acknowledged. I also verified the originality of contents through plagiarism software.

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Abstract

The study reported in this research explores the impact of a research-informed, school-based, learning appraisal in light of the impact of digital dialogue in curriculum using a social networking app “Talkwall” for classroom discussion The research is aimed at enhancing the standard of learning process to adapt to the changing nature of 21st century learner and the truth that the current educational system cannot take care of such demand without the support from ICTs.

This research concentrates on the significance of digital dialogue in the classroom, its attributes, quality and shortcomings, and success factors when used in education.

Through the use of a digital app, dialogue is encouraged in the classroom to make students able to be active participants in their learning process and to develop collaborative knowledge-blending, learning through inquiry and evaluating ideas. Further, it encourages the learners to argue, give a justification, defend and clarify their understanding, and be involved in the constructive and shared learning process. It motivates even those students to participate who are typically not that active Participants in class. It can also help in examining how students sharing of knowledge contribute to their construction of knowledge. While using digital dialogue in the classroom the students get an opportunity to engage with the content being taught and bring in what they already know thus making learning a two-way process.

The intervention was conducted on undergrad students of NUST for a period of one week. In total, 78 participants from two classes ranging from 18-22 years old participated in this study. Data was collected through paper-based pre and post-test to evaluate the impact of digital dialogue.

Keywords; digital dialogue, secondary classes, communication, shared learning, deep engagement, classroom discussions, knowledge construction, technology support.

CHAPTER 1: INTRODUCTION

1.1 Background

It has been four decades that study of dialogue in the classroom has been emerged as a noteworthy research area in linguistics and educational sciences (Webb, 2009; Dawes & Mercer, 2014; Abedin & Howe, 2013; Anthony, Resnick & Walshaw, 2008 Asterhan, & Clarke, 2015). Cazden 2001 said that classroom dialogue is a language of learning and it is produced through which learning in children takes place. The focus of research on classroom dialogue is on identification and promotion of teacher-child interaction and child-child interaction in the school setting which is very helpful in development and learning. In the early 1990s, Gamoran and Nystrand (1991) have already shown up that there is a strong association between classroom dialogue (discussions and open questions) and learning of children. It is surprising that recitation still dominates most of the classrooms specifically in form of IRE (Initiation Response Evaluation) sequences in which teachers ask closed questions and they give very little space to children for sharing their own ideas and reasoning. In a recent review conducted by Abedin and Howe (2013), they concluded that over the past decade, more awareness has been created about the classroom dialogue and to understand which modes of organization are more fruitful as compared to others. There is a lack of insight from various classroom dialogue modes to learning results of students. So, it is vital to contribute more to this research area by giving empirical evidence on the connection between dialogue in the classroom and the learning and development of students.

1.2 Motivation

Lack of interest and motivation to learn on the part of students have been observed that is mainly because teachers and the existing code of conduct are not satisfying them as they are technology natives, they should be given opportunities to learn in their own way. Some of the other reasons of low learning rate are: Teacher is the transmitter of knowledge (Bligh, Donald ,1998), Excessive information is transmitted (Steinert & Snell, 1999), One-way communication between teacher and students (Georg Breidenstein,2007). Lack of immediate individualized feedback (Danny Damron & Jonathan Mott,2006).

The use of ICT in a creative and most engaging way can bring out their interest that's why it is now important for the students to learn constructively through sharing information. It is often assumed that Existing approaches towards learning are not satisfactory, active engagement of students was not given much importance previously which may be a cause of low learning rate.

Digital dialogue is important to make students become active participants in their learning process and to develop collaborative knowledge-blending, learning through inquiry and evaluating ideas. It will encourage them to argue, give a justification, defend and clarify their understanding, and be involved in the constructive and shared learning process. It will motivate even those students to participate who are typically not that active Participants in class. It will also examine how students sharing of knowledge contribute to their construction of knowledge. The student will engage with the content being taught and will bring in what they already know thus making learning a two-way process.

Through dialogue students get to elaborate what is written in the text thus it results in deep understanding and students are much more aware of their learning process (Hagen, 2012). Dialogue provides the learner with deep engagement with the content. Findings of the past research conducted showed the positive impact that's why there is a need to implement it in Pakistan. Some Schools in Pakistan have already started to incorporate technology; hence, this can be implemented easily.

1.3 Online group discussions and its impact on students' learning

Peer collaboration has great potential and despite this, research has shown that its success varies. By the extent to which students get themselves engaged in specific patterns of dialogue such as explaining, elaborating and building on each other's ideas predicts differences in outcomes of learning (Schwarz & Asterhan, 2007, 2009; Menekse & Chi, this volume; Webb, 2009). Group members from capitalizing on ideas generated by others are prevented by social dynamics. Inhibiting factors are, along with others, unequal participation and domination (Barron, 2003), competitiveness (Babichenko & Asterhan, 2013; Asterhan, 2013; Khoo & Chiu, 2003), differences in social status (Lotan & Cohen, 1995) and social competencies' differences (Barron, 2003). Some of these difficulties are addressed by conducting group discussions in environments (computer-mediated). Oral talk is transient. Computer-mediated

textual conversations' content can be recovered and reviewed later at some time (Lockbridge & Brennan, 2006). Various pedagogical advantages for follow-up activities are offered by this reviewability. students may be asked to give a review about their own discussion protocols and also of their fellow students and also to identify reasoning types and provide suggestions for improvement. Reflection is encouraged by the acts of writing textual contribution, reviewing or editing it before posting even in the absence of teacher-initiated follow-up activities (Durndell, Ross & Guiller 2008; Archodidou, Anderson, Nguyen-Yahiel & Kim, 2007; Herring, 2011).

1.4 Digital teaching platforms and change in learning mode

Multiple interactive multimedia networks are the result of a fast revolution of wireless and internet communication technology. Messaging, mobile learning and mobile voice are included in interactive multimedia networks. Traditional styles of teaching will be replaced by using the internet for having digital teaching material which will also lead towards the achievement of national competitiveness. Due to this, many kinds of research on mobile learning have been conducted which also offer utilization universally and higher transmission process. The technology of smartphones and portable PDAs is getting mature and every individual carries a device. Nowadays browsing is much different from old methods of browsing in such a way that through the network, a user could link to the server and can choose the appropriate material for digital teaching and students are enabled to control the digital teaching material content due to instant tests. By a combination of current trends in teaching and benefits of practical strategies of teaching and digital teaching can be developed to make teaching style effective (Lai et al. 2012). Businesses and governments have invested a lot in development and research of digital teaching platforms under the conditions of change in learning modes. Various digital teaching contents are produced, hardware and software for multiple platforms of digital teaching have been developed and different schools have also incorporated patterns of digital teaching through which they expect to promote learning in students.

1.5 Rural-urban education gap and technology

For lessening the rural-urban education gap, use of shared education resources on a computer has become the trend all over the world. It is unavoidable for instructors adding technology in

subjects for helping in the learning of students with materials and methods of teaching and expanded teaching media. It is a major responsibility of teachers to make their teaching style more effective and they should make their students glad in the learning process. They should enable a new generation to think creatively and rationally with new technologies and network information. To achieve the learning outcomes, digital learning aims that the students participate actively in their learning activities. This would be very helpful for them (Tu & Pai, 2011). Flexible application of the tools of technology and digital teaching styles or digital learning has become the key issue for current information technology integrated education. It is stated by Yoon et al., that in 1999, Jay Cross proposed the E-Learning which is also named as digital learning. Different terminologies appeared with the advancement in technology such as web-based training, network learning, Internet-based training and distance learning. It was stated by Doris Holzberger et al in 2013 that digital learning basically involves digital forms of media such as images and text through the net and it enhances learning in learners via its innovative teaching methods and interesting content. So, it helps in the improvement of teaching methods and stimulates skills and knowledge. To end the limitations on schedule, time and site and to attain learner-centred learning, technology media and computers were applied to situations of learning; asynchronous and synchronous, both (Kaklamanou et al., 2012).

1.6 Digital learning and its impact

In industries and fields, there is a massive use of digital learning as in this era, information and knowledge are flowing rapidly. Definitions differ on the basis of various points of views and positions. The definition which is proposed by ASTD (American Society of Training and Education) is the most representative one. It has given a definition of e-learning as the process in which digital media is applied by learners in learning. Digital media contain satellite broadcasting, interactive TV, Internet, corporate network, audiotapes, computers videotapes and compact disks. Digital cooperation, learning (computer-based) and computer-generated classrooms are included in the application. Digital tool which is to attain materials of digital teaching is digital teaching. It is used for the online and offline activity of learning through wireless and wired networks (Hockly, 2012). Among international and domestic researchers, various explanations for digital learning have been revealed by current literature. There are

four parts into which digital learning can be divided according to the analysis of the viewpoints of some researchers (Keane, 2012).

- Materials of digital teaching: by mining and finding some contents of digital teaching, learning can be made easier for learners. Digitized data, e-books and contents presented with other digital methods such as digital dialogue are the digital teaching methods.
- Digital Tools: Through digital tools, when learning proceeds. It includes the use of educational apps, smartphones, desktop computers, tablets and notebook computers.
- Digital delivery: it says that activities of learning for learners can be delivered via satellite broadcasting, intranet and internet.
- Autonomous learning: it put emphasis on pupils who by themselves get involved in offline or online learning. Participation of leaders is required in it as it focuses on individual autonomous learning.

1.7 The role of digital dialogue in increasing learning motivation

It has been mentioned by Block et al. in 2013 that learning in its initial stages can be guided by outer motivation. They would not be required once it becomes autonomous. Extrinsic and intrinsic motivation would complement each other. Extrinsic motivation in the form of dialogue as a driving force is required by learning as it is common to learn for added objectives, expectations of parents and for attaining goals. In between reaction and stimulation, the mediator is the motivator for learning. It is crucial to provide students with an open space for dialogue because individual opinions about affairs are the learning motivation and because of difference in opinions, every learner would have his/her own knowledge acquisition needs. Karim in 2012 regarded learning motivation in such a way that it is intrinsic belief to induce learning behaviours to make efforts, improve and strengthen the outcomes of learning, guide goals of learning and reinforce cognition history. It was argued by Gruzd et al., 2012 that it would be expected by students that they would receive incentives for their behaviours by others; in this scenario, digital dialogue works best as learning was for a purpose but it could possibly be converted to intrinsic motivation from extrinsic. In the process of dialogue, students get opportunities to be appreciated for their contribution in the learning process where the motivation for achievement and transformation for grooming of self in process of learning

would be a nice motivational process although students might not be autonomous. Those who had intrinsic motivation didn't get incentives and they themselves could take their decision and attain a sense of success. Digital dialogue in the learning process works as an extrinsic motivation If we talk about extrinsic motivation, it is the motivation which others induce through punishments and appreciation. Environmental factors have an effect on motivation, that is influenced by external support and incentives whereas intrinsic motivation may be persistent with high value and its more autonomous as well (Im et al., 2011). In 2011, digital dialogue encourages students to take charge of their own learning process Mullins and Koff said that learning motivation is basically desire of students to take part in and struggle for the sake of learning whose basis was totally on choices of students about learning tasks and struggle on these learning tasks. In this study, learning motivation is defined as guiding students' continued efforts on the goals of learning set by the teachers in the process of learning. Students were preferring to work independently while solving problems and participate actively, but they would be assisted by their teachers in solving those problems (promotion of behaviour by digital dialogue as an external stimulus.) For the formation of learning motivation, cooperation is required of extrinsic motivation given by teachers and students own interests (intrinsic).

1.8 Traditional methods of teaching Vs digital methods of teaching

Between traditional methods of teaching and digital methods of teaching, various differences such as practice methods, content material and learning mediums are observed and pointed out by McKiernan in 2011. For courses which require teamwork and practical operation, traditional methods of teaching were better and for learning contents which focus on flexibility and convenience, digital learning is suitable. Traditional teaching cannot be replaced with digital teaching but digital teaching can make learners happy by integrating both methods effectively in teaching and this is how it can have the best teaching effects.

Differences between traditional learning and digital learning in persons and learning environment are described by Yien et al in 2011. The most representative and traditional method of teaching was "lecture" in the classroom. It is basically a procedure in which through interpretation, the teacher delivers teaching materials to the learners. It is still a favourable

method of teaching among instructors and it has been broadly applied in the past. Digital learning as stated by Sebastian et al in 2012 is the mode of learning which has developed fast in the past few years and it is also mainstream in future. It presented multiple strengths and broke all the traditional modes of teaching. All the benefits of digital teaching were organized by Miyoshi et al in 2012 so that they can be compared with the conventional methods of teaching. 1. No problem in learning: digital learning give comfort to pupils in the context of space and time which is not given by traditional learning. Through this, learners feel no pressure or hurdles of space and time via online interaction system. 2. Rich network resources: by simply searching keywords, learners can get diverse and rich data about their relevant topic from the internet. For the usage of learners, relevant resources are organized by digital learning and network resources can also be effectively applied. It also allows learners and teachers to gain rich data beyond the curriculum material which enhances learning effect (Im et al., 2011). 3. Tailored learning schedule and digital contents: regardless of the level of a learner, all learners were treated equally in traditional methods for same teaching content and schedule. In the case of digital learning, every individual is allowed to select subjects according to his/her calibre and level of preference so that outcomes may come good. (Sun et al., 2012). 4. Complete records of learners' learning history: learning history of every learner should be recorded in a good digital learning platform so that it becomes easier for an instructor to know about learning conditions of a learner and learner could also see where they need improvement. 5. Interactive learning: to generate more lively and attractive material, digital learning must incorporate sounds, media pictures and images as compared to traditional methods that do not use these techniques. For better communication and understanding between teachers and pupils, discussions and chat rooms are provided by platforms of digital teaching (Hockly, 2012). 6. Lessening of teaching costs: the material content which is used in digital teaching was stored as digital files which ensure that the material can be used again and again. It can also be said that instructors made the teaching material before lessons through which learners used it many times for learning. All learners were required to be gathered at the same place and same time for the instructions that there was an increase in teaching costs. 7. Effective gathering of knowledge: all online teaching material could be recorded in digital learning mode and it keeps learning the history of learners. It could effectively collect personal knowledge for learners. Through digital learning mode, the content of teaching material can be gathered and organized

in an effective manner and it can be given/provided to learners for effective implementation of knowledge (Jude et al., 2014). 8. Enhancement of learning interests: through information technology, instructions can be clearer and livelier and learning can be made more efficient by the presence of media. It also promotes learning persistence in learners. 9. Concurrent learning of new technology: promotion of usage of technology, digital learning put emphasis on learners learning new knowledge and new computer technologies and digital tools as well (Shin et al., 2011). It can be shortly said that digital learning makes learning easier and successful by including media. It makes learning attractive and provides them comfort by breaking the restriction of space and time. Attention is increased by learning motivation and it allows absorption of new knowledge. Model of motivation for teaching effectively, to enhance students' understanding and motivation with respect to learning was proposed by Kuo in 2011 to make productivity in learning. This model was developed to understand the association between effectiveness and motivation. The higher learning outcome will be presented by the students who have high motivation for learning as exposed by Sahbaz in 2012. There were positive correlations between motivation for learning and outcomes of learning.

1.9 Digital dialogue: A Tool of communication in the Classrooms

Students are in an active role when they are using digital dialogue as support or tool for communication with others. They are not in a passive role then. Over here, students actively think and choose pathways to produce, gather, manipulate and expose information/data (Chou, Block and Jesness, 2012). Use of technology enables students to ponder about knowledge and by using their skills they can make choices as compared to the environment of typical classrooms which are led by teachers. Students get a chance to define their aims and make decisions when they use technology as a tool that supports them in improving their performance of authentic problem solving. They can also assess their progress (Mostafa and Esmaeel, 2012).

Role of teachers also change. Through digital dialogue, the role of the teacher now is not of the dispenser of knowledge. Now the teacher is a facilitator who set goals for students and provides resources and guidance. They move students into groups and initiate activities for them by providing suggestions. As students work on their products (technology-supported), the teacher just moves around and asks students about their ideas and choices and then provides the

necessary support (Johnson et al, 2014). Whether technology is used or not, changes in roles are prompted by project works and approaches to cooperative learning. With new teacher role, digital dialogue when used as a pedagogical tool is highly compatible as it stimulates the minds of students actively. Moreover, when using digital dialogue, many peer coaches join the teachers and students who are eager to share their ideas and knowledge with others. Most common and we can also say the universal reported effect by teachers increased in motivation and enthusiasm (Mostafa and Esmaeel, 2012). This is sometimes very surprising for students and teachers that students show great performance and accomplishment in dialogue-based tasks as compared to those which are traditional academic tasks. From different perspectives, teachers talked about motivation in students. Some of them mentioned that motivation can be due to the specific subject area, for example, will or desire of a student to write on computational skills. General motivational effects were also discussed by others such as the satisfaction of students which they get when they are given feedback by the teacher or peers and when they work with technology, they get a sense of power and accomplishment (Johnson et al, 2014). In most of the cases, students availed their lunch break time period for working on their projects which were technology-based (Kaila et al, 2012). It has been frequently reported by teachers that digital dialogue provides them with a venue in which many of the students can excel. Digital dialogue provides them unique ways for their expression of knowledge and to assess what they have learned instead of the traditional methods in which classroom environment is stressful and their performance is evaluated by multiple choice tests. Unique digital ways include programming of stimulation for demonstration of a concept instead of explaining it verbally. The self-esteem of students was enhanced by technology effect as said by many of the teachers (Wegerif, 2010). confidence of students and teachers is increased when they feel competence after having mastery in tasks which are dialogue-based and also because of the awareness of its importance in our culture. Students are confident and they feel proud of using the tools which are computer-based and employed by professionals. One of the teachers said that from learning and usage of computers, students get empowered as they keep on using computers in ways in which they can associate themselves with the real world. In our culture, technology is valued (Kaila et al, 2012). It gives the power which adds value and it is something which costs money. We are giving weight to school activities through the use of technology tools. It adds creativity in tasks. Students are sensitive to this message which

conveys that they themselves and their work is important (Jude, Kajura and Birevu, 2014). Latest researches about how nowadays students prefer to use technology and innovative ways of learning like digital dialogue and how their learning is influenced by it exposed that interactivity and learning in students increase through the usage of modern tools of technology in the learning process. When helped with technology, they find it much more interesting and interactive as well (Im, Hong and Kang, 2011). It becomes very easy and convenient to transfer knowledge. It means that with the use of technological tools like digital dialogue, our minds have started working faster. It can be applied to any field but here, education is being discussed specifically. In these days in schools, colleges and universities, the dependence and reliance on this innovation have made life easier and inevitable (Hsu, 2012). Following are the ways in which technology can be used by students:

Internet connection and connectivity: Over the process of a decade, the internet has grown in worth a lot. We can never deny its importance in the field of education. Usage of the internet is no less than a blessing for students although it has some drawbacks and faults. Nowadays, in almost everything which is in our use, the internet is present. Internet is all around such as our phones, gaming counsellor and the internet as well. Students may get help from the internet such as tutorials and all other things which can ultimately enhance and improve learning (Gruzd, Staves and Wilk, 2012).

Using visuals and projectors: as compared to words, images are more appealing. Another form of technology use is using visuals and projectors in learning. All around the world, PowerPoint is being used for all kinds of projections and presentations (Michael et al., 2011). It keeps learning interesting and interactive. Motivation can be improved and interest level can also rise due to the use of technology (projectors) within college and schools. Appealing visuals are likely to be seen by students as they entice them to think deeply rather can saying good (Kristen, 2011). When it comes to technology, learning has become efficient. In the education sector, digital footprint: in the education sector, usage of digital media has grown to a greater extent nowadays. Through this advancement, students are getting facilitated, they are provided with forums from which they get the required help in their tasks and assignments and this has also resulted in connectivity with students (Chesser, 2011). As with this technology is

advancing, there are many applications like “Talkwall” which help students in learning and development and more applications will also be developed.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction:

There is a critical need for improvement of the education system and also to come up with new creative practices of education to meet the challenges which we are facing in this evolving and unpredictable world (Tanner and Jones, 2007). Moreover, by having effective practices, it doesn't unavoidably suggest that such follows can scale up to other sites (Gillies, 2015) say that it has to result in improvement in academic performance as a large amount of money (billions) have been spent on advanced practices. Limited knowledge of the scaling up process has been reflected as there is a failure to scale education innovation and also to improve the outcomes of students. A systematic review of research is reported by this study and it connects digital technology and classroom dialogue. While the establishment is made well on research related to dialogue and classroom talk, research about the latest technology which is a new zone and currently being used in classrooms and much recent one is the research into the interaction between technology and classroom dialogue. For assessment of the understandings in the research by enabling the community of research, scoping review is an appropriate tool.

Of the available evidence, offering, collecting and then assessing it are included in them (O'Malley and Arksey, 2005). At a high level, this is understood and analysed as well by which gaps and clusters identification is identified (Kitchenham et al. 2015). The ability to recognize the key characteristics of a diverse body of research in an allied manner is stated strength of methodology (Davis et al. 2009). Across a range of fields, particularly where these fields are breaching new ground, for review of educational research, accepted means are the scoping reviews (Virtanen et al. 2017; Watson & Major, 2017; DeLuca et al. 2015).

A major contribution is other work which reviewed research about CSCL also called as computer-supported collaborative learning (Jeong, 2016) and those encompassed in educational psychologists' special issue to the development of theoretical frames linked with collaborative interaction in reference of technology use. In this study, a major aim is not of creating or adjusting theoretical frames of understandings which are resulting from some specific studies; this is complementary to work assumed in this review as it is different. Range

of extant empirical work is examined systematically by the literature review as explained both below and above, presenting broad connections and results.

2.2 Studies of active engagement through dialogue in classroom

It is believed by many researchers and educators that certain talk such as academically good talk, dialogic discourse or accountable talk support robust learning for all pupils.

Rasmussen & Hagen (2015) conducted a research on microblog intervention "Facilitating students' individual and collective knowledge construction through microblogs". The aim was to prepare students in a constructive classroom dialogue. 25 students were involved in the study where they used a microblogging tool "socius" to summarize text information which was then displayed and shared with the whole class using a big projection screen. They used descriptive quantitative analysis to understand student outcomes. The results revealed that even those students who were hesitant to take interest in classroom activities were encouraged through this technology supported whole class discussion. The teacher's elaboration of the student's own contribution resulted in better understanding. Through microblogs, the students shared more dynamic perspectives of the topic being taught, and this strong contribution of students on the big screen helped the teacher to incorporate and conclude more on the student's own particular thought. The teacher played a very crucial role in making the class discussion a fruitful common source of information for the students.

These gains are persistent over the years and they are shown to transit across subject domains. It has been shown by many studies, across a range of grade levels and across a range of subject areas, that diverse learners are supported by well-guided discussion. These diverse learners include struggling learners, English learners and students from relegated communities. This contention is supported by various empirical results (Shayer & Adey, 2001; Sams, Dawes & Wegerif, 2004; Abedin & Howe, 2013; Clarke, Resnick & Asterhan, 2015). A clear trend has been shown in the studies which are in the first 4 articles of this issue. Bakhtin, 1981, in his terms, dialogic style of a teacher in which he/she conducts classroom can enhance and encourage a transition from authoritative interaction to persuasive interaction. In persuasive one, the tenability of propositions on practical and theoretical issues is based on active listening to each other, exchanging arguments and listening to each other. Need for further research is

stipulated by these outcomes (also emphasized by explanations of Liberali & Howe). It has been said by Abedin and Howe (2013) that 'dialogue' is not just limited to face to face interaction which is verbal in nature including prosodic and paralinguistic markers and also include distant textual sources including various tools and textual genres like ICT facilitated interactions (check reference to 'polylogue' in van Oers, 2015 & Dobber; Van der Veen et al., 2015). On the organization of the developmental trajectory of dialogic thinking from initial years, there is a need for longitudinal research. An early start is required for the formation of students' dialogic thinking so that all dimensions of this ability are developed which encompass critical attitude, verbal ability, dealing with insecurity, cognitive strategies, use of tools e.g. theoretical models for regulation of dialogues). This type of intricate longitudinal research may result in a deep understanding of dialogic talk's complexities and pondering about its promotion on evidence's basis. It has been suggested by Berkovich (2016) that there is a further need to study the effects of dialogic classroom culture on student's identities' development, transformative learning and critical thinking. Studies which seek understanding of learning advantages of multiple types of participation or active engagement across a variety of settings have s subset of studies which address the topic of vocal versus silent participation. It has been shown that passive observation is trumped by active engagement and some studies provide illuminating and refined interactional configurations' accounts. Hausmann, Chi & Roy (2008) said that if two students observe a videotape of another student who is being tutored will comprehend and learn more as compared to a student who observes that same videotape alone. Learning of scientific content was examined by Schwarz and Asterhan in 2007 specifically opportunities for conceptual change: conceptual shifts in understanding were experienced by subjects who really made and voiced critical arguments. When those arguments were heard by listeners, they didn't undergo conceptual change but they acquired knowledge. In small group interactions, detailed and notable findings on participation have come from Webb and colleagues (Webb et al., 2014; Webb, 1991). They investigate the actions which prove to be helpful in student learning in small groups: it was found by Webb (1991) that there was a significant positive association between content related explanations and achievement of student while receiving explanation was not related; it was exposed by Webb et al. 2013 that clarification of students' own ideas was positively correlated with the achievement outcomes and another factor which added this effect was having other students engage with one's ideas.

In science education, increased attention has been gained by dialogic modes of learning and teaching as probable practices which afford students with great authorship, meaning and many chances to learn (Clarke, Resnick & Asterhan, 2015). This is in contrast to impersonal, authoritative and narrow approaches in which classroom discourse does not permit bringing together and exploring ideas, that concerns the interests of students. In dialogic learning, the teacher plays a vital role in creating an environment for students which is interactional where they can think and talk together creating an intersubjective alignment (Michaels & van Kruistum, 2015) that support examination of various views (Gamoran, Long & Zeiser, 2003). The dialogic approach has some critical features which provide opportunities to students to negotiate their scientific and everyday reasoning, appreciate the cultural norms, manage alternate viewpoints and build personal identities and dispositions towards science (Kumpulainen & Kaartinen, 2012). In the Finnish National Core Curriculum, these elements are becoming increasingly focused that while developing disciplinary knowledge in students, it addresses competencies of students to learn to negotiate, collaborate and make scientific knowledge and meaning.

2.3 'A Space for Dialogue'

By providing a thematic overview, some studies continue. To open 'a space for dialogue' in our discussion, we chose this pathway in the work which has been presented. This exploratory exam takes into account studies that combine classroom dialogue and dialogic pedagogy, also it identifies and explore many field studies. In view of the rising interests of researchers and professionals, this work is vital in the dialogue's role in learning of students and interest in technology's role in its improvement and supporting. Growth of dialogue continues (somewhat it gets motivated by the growth of digital technologies which include computers that can promote interactions in classrooms (Major et al., 2017). We can assume that it is probable that a noteworthy amount (in terms of time and financial) of resources in this area in the coming time will be invested, so through these two points for the first time combined in a comprehensive review, the parties involved can develop a synthesis of existing research to shape latest productions in a widely and rapidly growing domain. Essentially, the revision is an interpreted map of existing knowledge, in which the underlying geography is the basis for the reinvention of landscapes (Lemon et al, 2016).

There is a rich tradition of the examination of classroom talk, including researcher's noteworthy contributions working in the fields of Corpus Linguistics, Conversation Analysis and Discourse Analysis. Barnes's (1976) work is important for those who consider learning from a perspective which is socio-cultural (Vygotsky, 1962) in defining talk type where it is seen as crucial and effective for learning and thinking and it is a component of clear trajectory in academic discourse (Abedin and Howe, 2013; Baker and Schwarz, 2016; Dawes and Mercer, 2013; Alexander, 2008). In the examination of pedagogical approach which involves promotion and classroom dialogue, this research into Accountable talk and 'Exploratory Talk' (Mercer, 2000; Barnes, 2008) has become central. Dialogue is talk which is effective for learning in school subjects and classroom settings, it is not 'just talk' (Michaels and O'Connor, 2007 and Cazden, 2001). Dialogue is not just a conversation (O'Connor & Michaels, 2007; Cazden, 2001). Discourse is a creative way for learning the school subjects while used in and out of the classroom settings. By being focused on the assessment of ideas and their exchange, the collective construction of ideas, reasoning, and development, as well as the use of evidence in support of arguments, the dialogue should enable the individual's understandings about perspective and knowledge with the aptitude of reconciliation (O'Connor and Michaels, 2012). There are a few advocates of dialogue practices in education, they argue that in process of meanings and defining, dialogues are very important and also known as the core of learning process (Scott, 2003; O' Connor and Mortimer, 2012).

2.4 Computer-mediated dialogues and Students' learning outcome

Frijters et. al (2006) in "Effects of dialogic learning in value-loaded critical thinking", developed two lessons for teaching critical thinking, a dialogic lesson series and a non- dialogic one for an experimental study. The results indicated that the critical thinking of the students was improved in the dialogic series both in terms of fluency of reasoning and quality of value orientation. Critical thinking as indicated by the authors is very important to develop such competencies to be able to take an interest in society mindfully. The sample was comprised of 297 students. In this study, a pre and post-test experimental design was used to compare the outcomes.

Interactions (computer-mediated) have many advantages and one of them is that online actions are noticeably recorded. For group processes' automated detection which needs intervention, this log file can be used (Mikšátko, McLaren & Scheuer, 2010). Development of pedagogical agents is a way to use this information which intervenes and guide the group process (e.g., Howley, Dyke, Adamson & Penstein Rose, 2012). We selected a different approach to the latest development initiative. We choose to combine the benefits of both human expertise and technology instead of replacing human expertise. A system named as Argunant was developed with the aim of supporting instructors in their efforts and attempts to give online support of simultaneous discussions of students and also to provide real-time (Hever, Hoppe & de Groot, 2009; Asterhan & Schwarz, 2011). In this system, human teachers are provided with the automated detection of group processes with the aid of selection tools, teacher-tailored visualization such as awareness tools and alerts. Information is kept updated from time to time and appears in various forms (from delicate to intrusive).

For instance, social network is included in order to analyze the interaction patterns, when there is low participation level by someone, and when someone receive negative feedback, activity patterns, for example, to explore whether some specific dialogue pattern is rare or not, keyword searches in order to explore what concepts are being used by students, along with visualizations in order to track group processes along with the development of individuals in reasoning quality (Asterhan & Schwarz, 2011). There is no suggestion by the system when and how there should be intervention by the teacher as a teacher observes each and every child. All the decisions are made by human judgment (Hever, Hoppe & de Groot, 2009).

2.5 Dialogic teaching and mediating role of digital technology

Some commentators see the ‘classroom dialogue' as dialectic rather than dialogic, as the enculturating direction of the curriculum predetermines the eventual purpose. Alexander in 2008 proposed the idea of ‘dialogic teaching' claims that pupil learns to discuss, give reasons, argue and explain in an environment where classroom dialogue is used and this helps in developing their higher order thinking and articulacy as well. Students improved in collaborative problem solving and reasoning when they were taught the dialogic skills as shown by the research (Kuhun, 2016; Abedin and Howe, 2013; Mercer, 2013). In interactions of

classrooms (Nystrand et al., 2003), direct effect of participation to develop and legitimise contributions from all parties is because of dialogic pedagogy; in Bto foster learner agency, it is a central intention where to seek understanding students work together (Collaboratively) as along with their own ideas, they acknowledged and merge opinions of others to make modifications in their own thinking (Warwick & Flitton, 2013). Evidence of advancements in subjects as a consequence of pedagogy which is dialogic in nature is present (Mercer et al., 2003; Mercer and Drummond-Rojas, 2003; Baines et al., 2007). From UK-based efficacy trial which includes 500 students have reported hopeful results described as being discreetly safe (EEF, 2017). Indication of positive influence on achievement in English, Mathematics and Science was reported because of Dialogic Teaching intervention which involved children of age range nine-ten years. On possible interdependency of digital technologies and dialogic pedagogy and on their interaction as well, much attention is paid in recent years, extending the Binterthinking's idea (Mercer and Littleton, 2013) and growing 'dialogic space' (Major and Wegerif, 2018). Mediating role of digital technology has gained primary focus including interactive whiteboards, tablet computers and computer-mediated tools of communication (Haßler et al., 2016)- and it allows the collective knowledge building in classroom environments (Bereiter and Scardamalia, 1994; Ludvigsen and Rasmussen, 2010; Hakkarainen, 2009; Rasmussen, Ingvill & Hagen, Åste, 2015). It has been suggested by Sfard (2008) and Wegerif (2013) who are proponents of Computer-Supported Collaborative Learning, also abbreviated as CSCL suggest that new forms of discussions can be provided by the technologically mediated mode of interaction and discourse (Stahl et al., 2014, Riikka and Kenneth, 2018). Moreover, to include semiotic-mediated activity, extension may be done to the conventional understanding of dialogue (Wikan et al., 2010), when images are manipulated on large interactive screens for initiating group dialogue and thinking, subsequent positioning contributes (Warwick et al., 2010; Warwick and Hennessy, 2010; Hillier and Beauchamp, 2014; Hennessy, 2011). To explain how dialogic interactions can be enabled by digital technologies which were asynchronous and not face to face is shown by other studies (Staarman and Pifarre, 2011; Linn and Hoadley, 2000, Manoli, 2019). Possibility of 'transformative' learning is suggested by the alignment of digital technologies which are classroom based with the pedagogy (digital in nature). In Abedin and Howe's organized review of research (empirical in nature) in class dialogue (Staarman 2009; Kim et al. 2007; Rika et al,

2016) cited studies which were digital technology related and pilot searches located the research which was recognized as relevant previously. Studies which were found as potentially relevant had an exclusion and inclusion criteria. Studies were included if they related to learning in schools (students ranging from 4 to 18 years) and dialogic teaching and if they involved digital technology, explain primary empirical research (acquired through experimentation and observation), written by using English language, external audit was done which means peer-review and their publication was done between 2000 and 2016. It is interesting that previously digital technologies in areas of education were established for other multiple purposes instead of the activities which were education specific (Laurillard, 2008).

On technology designed by researchers, multiple studies are based or developed especially for the purpose of the educational sector (for example PICCO multimedia science learning platform which is subject-specific tool). There are various methodological assumptions as revealed by the scoping review which also characterise the research in digital technologies and classroom dialogue. Most of the studies are mixed method or qualitative and this is not usual as customarily empirical social science research is always dominated by quantitative research (Tashakkori and Teddlie, 2009; Gert et al, 2008). Nature of research in connections between digital technologies can be explained by this. The focus of the studies which intend to comprehend the associations on their characteristics which are micro-genetic, noting the techniques in which affordances of technologies transpose the meaning of dialogue itself or prompt conventional dialogue, sometimes taking in consideration the semiotics as a medium to understand communication via technologies (Emerson, et al, 2015). In the review, various studies are included which may be characterised as being implicitly or explicitly informed by understanding socio-cultural framework, since the importance of the association between the person and his/her environment and technologies as well is focused by this perspective. IWB also known as interactive whiteboard may be used as a medium to support the learning of students through dialogue (Hennesey, 2001). Opportunities for learners have been opened by this highly prevalent and strong technology to produce, modify/mould and assess new ideas through talk and also the multimodal interaction. Reasoning processes are made more explicit, the making of ideas and differences between perspectives are highlighted by the rich new forms of dialogue. Upon Bakhtin's conception of the notion of technology given by Wegerif (opening

up space (dialogue) for reflection, the emerging account builds but the role of mediating artefacts is foregrounded.

2.6 Online guidance of teacher improves student discourse

Descriptive studies related to the practices of e-moderation have shown amazing positive results with reference to students' learning. Therefore, it was found out that moderation has quite a positive impact on the peer discussions' quality. E moderation gives a teacher a chance to positively interfere in the function of the group. In order to answer this question, many studies have been conducted and they raised a question that whether online guidance from a teacher has a positive impact on the student's learning outcome. Hence, there is a need for controlled experiment in order to answer the question properly. Asterhan, Schwarz, & Gil, 2012 conducted in-vivo experiment that made them able to demonstrate the positive effects of the guidance of teacher on the 9th-grade students' group discussion where there was a mall argumentation. "Based on differences in moderation behaviour that were documented in a field study" (Asterhan, 2011), moderation behaviour's two types were defined by the authors in order to improve the online discussions of the students.

· Epistemic guidance

The aim of this type of guidance is to give assistance to the online group in order to present arguments as well as counterarguments very clearly while keeping various perspectives over one issue or topic

· Interactional guidance

On the other hand, Interactional guidance is considered to be guidance whose main goal is to improve argumentation in the group through the exploitation of social situation, students are greatly encouraged to express their notions, ideas and thinking without any hesitation of being judged and other students respond to them with their own perspective over that topic. One condition out of three was assigned to the three or four students in a group: Groups of three to four students were randomly assigned to one of three conditions

Epistemic guidance by the teacher

Interactional guidance by the teacher

No guidance by the teacher

The timing, as well as content related to the intervention of a teacher, was controlled very tightly, as per the condition. It was shown by the results that discussion's argumentative quality improved due to epistemic guidance, but it did not play its role in improving the interactivity as well as participation rate among students. It was found out that the guidance of a teacher can have a positive impact in an online environment on the students' discussions that fits the moderation's intended goal reasonably.

It has been demonstrated by many researchers that dialogic skills play their role in improving problem-solving as well as reasoning (Kuhn, 2016; Mercer 2013; Mercer et al. 2004). There is a direct impact of dialogic pedagogy on students' learning outcomes and it is important to develop as well as legitimize all parties' contribution in the classroom discussions. (Nystrand et al. 2003) As many stated that "a central intention is to foster learner agency, whereby students collaborate with others in seeking understanding, building from their own ideas and allowing other ideas and opinions to mediate and modify their thinking. There is also evidence of subject learning gains as a result of a dialogic pedagogy" (Baines et al. 2007; Mercer et al. 2003; Rojas-Drummond et al. 2010). Indeed, it has been described by the findings that dialogic teaching has a positive impact on the students; learning outcomes as they express and interact more with others. A study was conducted on the 5000 students aged 9-10 from the UK, and through the intervention of dialogic teaching has a quite positive impact over the learning and they scored good marks in Maths, English and science, they seem to be more interested in participation when dialogic teaching method was adopted. (EEF 2017). According to Alexander (2008), the requirement of this pedagogy is not only those students are engaged by a teacher in a very thoughtful way, but it also plays its immensely significant role in helping students to work in groups in a collaborative manner without their teacher. As he further states that "students cannot be assumed, on the basis of their out-of-school experience, to be familiar with the kind of reasoned discussion represented by Exploratory Talk, part of implementing a dialogic pedagogy must involve ensuring that students know how to engage in that type of dialogue." In this field, it has been proved by the key researchers (Mercer & Hodgkinson, 2008; Littleton & Howe, 2010) that the educational dialogues' quality is a factor which can be

regarded as significant for the academic progress of students. It has been indicated by many researchers (Mercer, 2008) that the children's capacity is increased by dialogic teaching as they help developing subject knowledge along with reflective thoughts. It has been illustrated by many studies that dialogic pedagogy with the help of technology can play a crucially important role in the development of the individual as well as group's reasoning skills.

2.7 Impact of digital learning on learners in classrooms

Teachers and learners facilitate the classroom dialogue in the context of interactive social media app talkwall's use and constructing the knowledge which is represented digitally. The meantime records of activity are constituted by the app, visible resources like talkwall are continuously evolving and rather than finished products of dialogue, it acts as supportive devices for emerging thinking of learners. Examples from case studies of classroom practices in the UK are some of the examples for illustrations of the primary theoretical account. Through cumulative interaction with a succession of digital sources which are linked and through revisiting and archiving previous artefacts, IWB was exploited by teachers. This has been illuminated by analysing lessons in sequence. Progression of dialogue over the time period, across groups of learners and also across settings was supported by the tool. To sum up all this, we can say that the article offers some examples which are practical in nature and it reframes the notion of dialogue for this context which is new and in which students are directly manipulating digital artefacts and are also actively creating them. Design-based research review done over the previous 10 years is presented by Andrew in 2007, the research promotes and model reasoning of students, argumentative dialogue practices and processes and conceptual change through developing various games.

2.8 Impact of technology and dialogue on students' critical thinking skills

Robyn M. Gillies in his study "Dialogic interactions in the cooperative classroom" showed examples of both teachers and students dialogic associations and talked about the complementarity of these discourses. The research was led in three years with 7 instructors and 17 student groups (3-5 students in each group) where instructors were relied upon to utilize a dialogic approach towards educating to challenge student's reasoning and learning in a cooperative inquiry-based science classroom. The study was aimed at how the teachers take

part in dialogic teaching, concentrating on advancing their reasoning ability, problem-solving and thinking in students, and the sorts of dialogical intercourse student's use as they cooperate. He came up with the conclusion that dialogic approach towards teaching and learning has the ability to improve student's reasoning and critical thinking that results in better learning.

Projects which dealt with conceptual change in science gave rise to insights, that also inspired researches for investigating the impact of technological line of work in education. By some projects, gamification tools such as InterLoc, AcademicTalk and CoLLege have been designed and assessed as highly interactive. previous research has also addressed the pedagogical and dialogical requirements for the development of knowledge, improved reasoning and conceptual understanding, in many of the contexts (Barrera et al, 2016) About the role of related innovations and dialogue in the process of learning, the key insights are provided by a reflective analysis of dialogic line of work. The technology of smartphones and portable PDAs is getting mature and every individual carries a device. Nowadays browsing is much different from the old methods of browsing in such a way that through the network, a user could link to the server and can choose the appropriate material for digital teaching and students are enabled to control the digital teaching material content due to instant tests. By a combination of current trends in teaching and benefits of practical strategies of teaching and digital teaching can be developed to make teaching style effective (Lai et al. 2012). moreover, some of the objectives of learning may be intolerable or problematic to achieve in ways that provide the learner with lesser opportunity of expression and communication and are conventional. It has been reported by the field study report which is school-based, all the students were taught correct physics, significant alternative concepts were retained by these students which were only reconciled via involvement of the dialogic games. Significant improvements can also be made in the understanding of learners without involving an expert tutor through a collaborative dialogue about a topic. It has been argued by Rijlaarsdam, Stan & Greet (2006) that competences must be included in Education that is needed by students so that they can participate actively in a democratic society with proper responsibility. A major concern is that in a domain-specific knowledge and skills, how it can be included in a curriculum. In the present study, in prevocational secondary education, teaching critical thinking implemented in the subject of biology is presented. 297 students were included in the sample. For teaching value-loaded critical thinking, two lesson series were developed: Non-Dialogic series and Dialogic series.

The results depicted that positive results were yielded by dialogic learning as compared to non-dialogic learning. Positive results were on students' critical thinking competencies in terms of quality of orientation of value and reasoning of generative fluency. High scores obtained on variables of critical thinking were not at the cost of the subject of biology's knowledge which was being taught in these lessons. Most often there is a link between dialogue and critical thinking. A part of the critical thinking method is fostering dialogue. according to Paul (1992) for the reason that we take in account other's perspectives while we start a dialogue and it results in 'the evaluation of fact entitlements. Active learning of students and higher-order thinking skills are expected to be promoted because of the dialogue feature and cooperative learning (instructional formats) (Perkins and Salomon, 1998; Renshaw, 2004). Cognitive elaboration process is affected by the social interaction as emphasized by cognitive perspective (Wood, Elshout-Mohr and Dekker, 2004; King and O'Donnell, 1999). Thinking gets stimulated and knowledge is also developed by language functions such as queries, reasoning and explaining (Dawes and Mercer, 1999). Focus is on "the process of becoming a member of a certain community" from an approach which is a social-constructivist approach (Wells, 2000). 'Dialogue' is a form in which we see learning as it is a form of collaborative meaning making (co-construction) (Wardekker, 2004). We have borrowed some elements from the social constructivist approach and cognitive as well in this study, on 'dialogic learning'. From the cognitive perspective, it has been taken that critical thinking skills are enhanced by 'elaboration'. From a social constructivist approach, two elements have been taken. First one is that content of learning must relate to the real world which means it should be meaningful. It should also relate to the position of students and of others and their opportunities as well which impact their position. Second one is engagement in classroom dialogues which enable a student to gain exposure in "skills and dispositions" such as "being able to relate a question to one's own standards and values", being able to relate questions to general things such as consideration, respect, social justice, equality, being open towards and considering other people', "daring to express a different opinion". As compared to discussions in which the whole class takes part, interactions in small groups are better and suited (Haworth, 1999). For stimulation of critical thinking, dialogic learning is a good instructional technique. It enables a student to push the limits and go beyond the 'knowledge telling' level (Scardamalia & Bereiter,

1987): further thinking is stimulated when questioning occurs by other people and about first-hand issues, moral perspectives are added.

2.9 The impact of digital learning on teaching-learning relationship

Nowadays, a supportive environment is required where learners want to communicate and connect. From “older" generations perspectives, they see computer chatting and texting as a form of communication which is as” the opposite and the antithesis of contact,” but for today’s generation it “allows interactions with a variety of material and people" (Windham,2005). It was asked from students by Milton and Dunleavy (2009) that what are their requirements/needs about an ideal school and how to increase engagement via learning environment. Three criteria were listed by the students which correlate to the interaction concept: 1. Learn from the community and from each other as well, 2. Connections with expertise and experts and 3. more opportunities for conversation and dialogue. These conversations and dialogues extend beyond classrooms. Learners want to have a conversation with engineers in the field if they engage in physics.

. Windham (2005) suggests, “Students should be given the opportunity to interact with faculty and researchers outside the confines of the curriculum and to develop meaningful relationships with them (p. 5.8).”

A shift from vertical classrooms to horizontal ones is required so that expanded relationships may get facilitated – no longer sage on the stage, teachers are helping students and learning alongside students while helping them to gain knowledge and experience. In Milton & Dunleavy 2009, it has been noted by Friesen that deep reciprocity in teaching-learning relationship is required by authentic intellectual engagement where engagement of students begins as learning in partnership with teachers- is actively constructed and new knowledge is built. when ideas are contributed in doing that it is “worthy of their time and attention (Milton and Dunleavy, 2009).” Such type of teaching involves more negotiation, interaction and exploration among teachers and learners as they discuss the content together and explore them. This is mainly modelling teachers as compared to those in which students are told what kind of outcomes should be and what to answer (Claxton, 2007). In learning, development of social and psychological engagement and supporting it is crucial, the relationship between teachers

and learners should be respectful, open and caring and they are also part of the new curriculum itself (Milton and Dunleavy, 2009). Today's learners get engaged in classroom practices which are based on problems, inquiry and exploration (Barnes et al., 2007; Milton, Willms and Friesen, 2009). These findings are supported by the research which is longitudinal in nature and is Alberta-based (Taylor, Parsons and McRae, 2006). Nowadays learners are motivated to find solutions by themselves by asking for an opportunity to explore (Windham, 2005): same is the case like we click on path via cyberspace to learn about the web so through exploration we want to learn subjects. To accept the words said by the professor are not enough. To find solutions and reach towards findings, we want to get our self-challenged. In the wish to learn, our need for exploration is implicit. How much worth is of engaging students in the digital world? It is necessary as said by educator Paul Gee and Elisabeth Hayes. It has been said by Paul and Elisabeth (whose learning in the digital age and recent language) that language is being reshaped by digital media and major role is played by oral language. It has been noted by them that children are getting easily attracted towards new forms of digital media in forms of games, videos and social media usage. It has been explored by their work how the paradigm shift for schools might be created by methods of learning. It has been reported by Hay (2000) "Net Geners want more hands-on, inquiry-based approaches to learning and are less willing to simply absorb what is put before them" (Marateo, 2007). They intend to explore it fully to find out what actually works. Kids of today's generation use the internet and observe/watch people doing things and then they replicate them by themselves. This actually brings us back in a loop where discovery, navigation and judgement come into production. It has been said by Brown (2000) "Learning becomes situated in action; it becomes as much social as cognitive, it is concrete rather than abstract, and it becomes intertwined with judgment and exploration." There is a probability about the knowledge that it will not transfer beyond the classroom if the environment of exploration of learners is antiseptic and is lacking background. To move past classrooms, such exploration is tied to request of learners: students often wish to take their learning and research in fields in which they are studying and in a larger community. It is more engaging as compared to reading seeing how "a thing works in real life." Need to make learning more contextual is spoken about in Oblinger & Oblinger's 2005 chapter of Zia & Ramaley 2005. Board on children, grown-ups and relations (2004) NRC report which concentrated on keeping grown-ups motivated and engaged in schools pointed research-based

recommendations. Two main ideas arose: 1. Formation of good contacts among experts and learners and communal context which is basically for their learning and 2. Manufacturing instructions & curriculum related to cultures, skills and goals which are for long term and future. For engagement of learners, curricula and activities are suggested by Claxton (2007): (1) Relevancy: connection between topics and interests/concerns of students; (2) Responsibility: control of students over why, what, how and when learning is organized by them; (3) making progress and solving problems matters to some individuals. Students are able to interact globally with events and people as they hesitate while speaking with experts in the field and it is also difficult for them to go beyond or after classroom time for learning.

2.10 The impact of ICT-based curricula and problem-based learning in classrooms

Technology is a tool for engaged learning as it makes relevant subject's material and learners assessable. In classroom toolbox, common call for new tools was issued by researchers and students, expanding beyond overhead projectors and standard computer to build connections between experts and learners (Project Tomorrow, 2010; Brown, 2000). List of multimedia tools was made by Ferris, Barnes and Marateo (2007) from the literature; but only a few methods (technological) are represented which enable students to engage themselves in discovering, education and build new knowledge. The list includes; video documentaries, blogging, WebQuests & other multiple projects of multimedia. These examples illustrate how students learn activities by themselves via the use of technology and meanwhile they ensure that they are devoting their time to critical thinking skills and higher-order thinking. It has been suggested by the project named as (Tomorrow's speak up 2009) that worth of technology is in hot debate by some of the learners who have and use Blackberries & iPhone and other such devices for better communication, research-based work or social activities which depict increase in engagement by seventy-eight percent (Project Tomorrow, 2010, p. 8). Technology and multimedia (video editing, sound recording equipment, gaming software, video, animation, cameras, projectors, smart boards and the global PowerPoint™) have proven that students find them helpful in learning their subjects and exploring methods through which they can present their learnt matter and also in controlling their learning (Project Tomorrow, 2010; Milton and Dunleavy, 2009). Caruso, Morgan and Kvavik (2004) state, "Students recognize a number of

benefits of classroom IT including convenience, management of classroom activities, time savings, improved learning, better and more effective communications, and better presentation of their class assignments". Use of emerging technologies for learning is discussed in a paper titled as "Unleashing the Future" and it has been reported by teachers that students get engaged including affective, academic, cognitive, social and academic engagement. In classrooms, easy availability to technology in classrooms heightened the level of engagement of students for example learning or acquiring knowledge, engaging actively, timely tasks, use of resources wisely, interests in tasks and desire to follow the latest information and go beyond classrooms material. Students are motivated to learn by 51 per cent due to the use of technology in classrooms, and their application of knowledge to practical problems increased by thirty percent and 23 percent increase is ownership of their learning. It is also reported by teachers that students are developing twenty-first-century skills including critical thinking and skills in problem-solving (27%), creativity (39%) and collaboration (30%). As teachers have recently got time to differentiate instructions 31% as the experience of learning becomes more meaningful and they have more information to how is the academic performance of students (Project Tomorrow, 2010). Technology is being used by students studying in K12 to gain knowledge, analyse it and finally share it as reported by Celebrating School Improvement (2006) by Taylor, Parsons and McRae. High achievement and quality work were the positive outcomes and more important was the motivation of students and time spent on tasks was also reported to be increased with technology in Alberta's classrooms. "a rich learning environment" was to be created by a component of "technology and multimedia" for improvement in engagement of learner which allowed exploratory, curricular and interactive learning. The learning environment includes two devices, teaching and physical. Physical includes computers and experiment kits whereas teaching ones include assessment methods and the activities in which pupils engage (Hennessy, 2011). Pupils score higher in academics and overcome their affective and cognitive difficulties because of the technical studies and science along with flexible, rich and computer-aided learning environment (Doppelt and Barak, 2002). It was found by Taylor, McRae and Parsons in a province-wide assessment of projects of schools which added technology in their curriculum that "Report after report further substantiated current research that ICT-based curricula and problem-based learning combine to engage students as never before in learning and working together". Students were made to

cooperate with each other during lunch hours and after school as well to work on projects. Doppelt and Barak have the same stories of engagement of students who were being provided by the facility to work with LEGO™ technology. Authentic and technological projects were created by the students who previously were low achievers and disengaged but then they were provided with a rich and flexible environment which was technological. They used their own imagination and creativity and then did their work in rich portfolios (Doppelt and Barak, 2002). It increased their productivity to a greater extent. They developed research skills which were refined and also a solid passion for learning: as reported by findings, self-esteem and self-confidence increased. Students' intentions to continue studies and attitude towards their everyday tasks and learning also changed). So it can be argued that all the researches mentioned above have an agreement on one point, which is digital tools, equipment, as well as resources can be used effectively and they play their significant role in raising the depth and speed of primary and secondary schools' students' learning. There is no doubt that Digital technologies have appeared to be effective as well as appropriate means in order to improve fundamental and basic numeracy and literacy skills in both primary as well as primary settings.

Generally, the impact's level is like other changes to teaching practices that have great impact n high school students. And they prove to be highly effective in achieving high standards of learning though there are many other objectives the digital learning or digital dialogue in the classroom have. In addition to this, the impact of digital dialogue might be greatly influenced by the capability's level of a teacher who teaches those students in high schools since they should know how to use the tools and other resources effectively in order to educate the students as they would have a greater impact on learning outcomes. Digital teaching has been very effective in the classrooms of high schools as it raised attainment when the teachers are capable enough in order to find out how these tools can be used in order to raise attainment while having the knowledge as well as the comprehension of technology. As Connor and Michaels (2007) stated: "Where learners use digital learning at home as well as at school for formal and non-formal learning activities these have positive effects on their attainment. This is due to the extension of their learning time. This is particularly important for secondary age learners." It can be considered the most promising evidence that digital tools play their immensely significant role in building skills in collaboration as well as interactivity, leadership and critical thinking for high school students because this is considered to be important skills

attained by an employer. It can be denied that for high school students, digital resources which are coupled with digital equipment, as well as tools, can have a greater impact on the enhancement of knowledge and career pathways' understanding, applying to work as well as working environments. For the employer, such resources make the way easy for employers in order to provide help and assistance to learners.

CHAPTER 3: METHODOLOGY

3.1 Overview

This Chapter identifies the project setting as well as the method and materials used for conducting the research. The quasi-experimental design was used in this particular research, to investigate the impact of digital dialogue on conceptual understanding of students by using an open source educational application "Talkwall" available at (www.talkwall.net). This chapter also aims to discuss the research design adopted, sample size, data collection tools, and the participants. The research was done on under grade students of NUST where most of the participants fall into the age group of 18-22 including both male and female participants.

3.2 Research paradigm

To conduct this research the participants were divided into control and treatment groups to contrast and compare them using Quasi-experimental method. The control group was selected to be as similar to the treatment group as possible. Whereas of those two similar groups, only the treatment group went under the experiment (taught using digital dialogue app "Talkwall") while the control group was taught in the usual conventional method. (White & Sabarwal, 2014). Convenience sampling method was used for selecting the sample depending on availability and permission for experimentation. The present study is focused on social research, therefore "The Nonequivalent Groups" design of Quasi-Experimental framework was preferred for it (Trochim, 2006). In the said design it is aimed to distribute the participants into groups that are as similar as possible but it cannot be assured entirely that the groups are comparable (Trochin, 2006). Figure 3.1 summarizes the types of quasi experimental design.

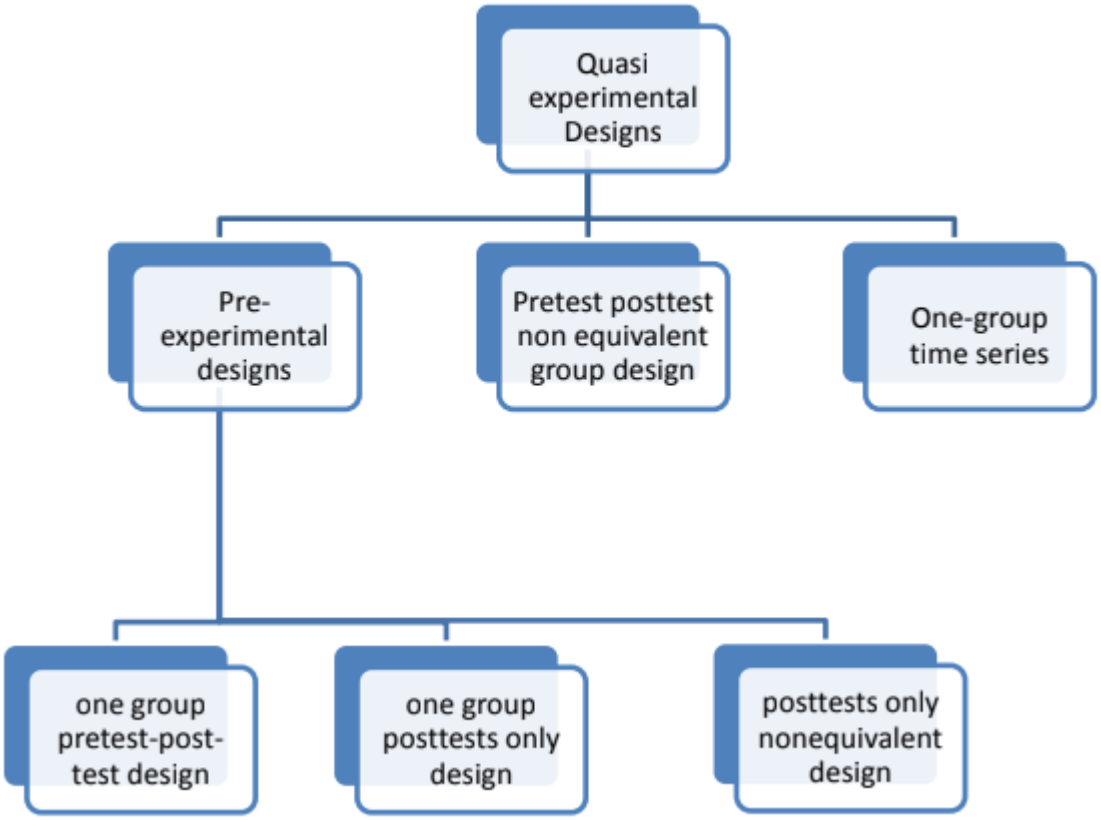

Figure 3.1 Types of Quasi Experimental Research Design

3.2.1 Identify and define the research problem

Lack of interest and motivation to learn on the part of students have been observed that is mainly because teachers and the existing code of conduct are not satisfying them as they are technology natives, they should be given opportunities to learn in their own way.

It is often assumed that Existing approaches towards learning are not satisfactory, active engagement of students was not given much importance previously which may be a cause of low learning rate.

This project of incorporating Digital dialogue in the classroom was aimed at enhancing collaborative knowledge-blending, learning through inquiry and evaluating ideas. It will encourage students to argue, give a justification, defend and clarify their understanding, and be

involved in the constructive and shared learning process, to examine how students sharing of knowledge contribute to their construction of knowledge. The student was engaged with the content being taught using the digital dialogue app also they bought in what they already knew, thus making learning a two-way process. To investigate the impact of digital dialogue the following research questions were formulated:

Research questions:

- What is the impact of digital dialogue on the conceptual understanding of students?
- Does digital dialogue impact student engagement and class participation in their learning process?

Figure 3.2 enlists the procedure for conducting a quasi-experimental research study

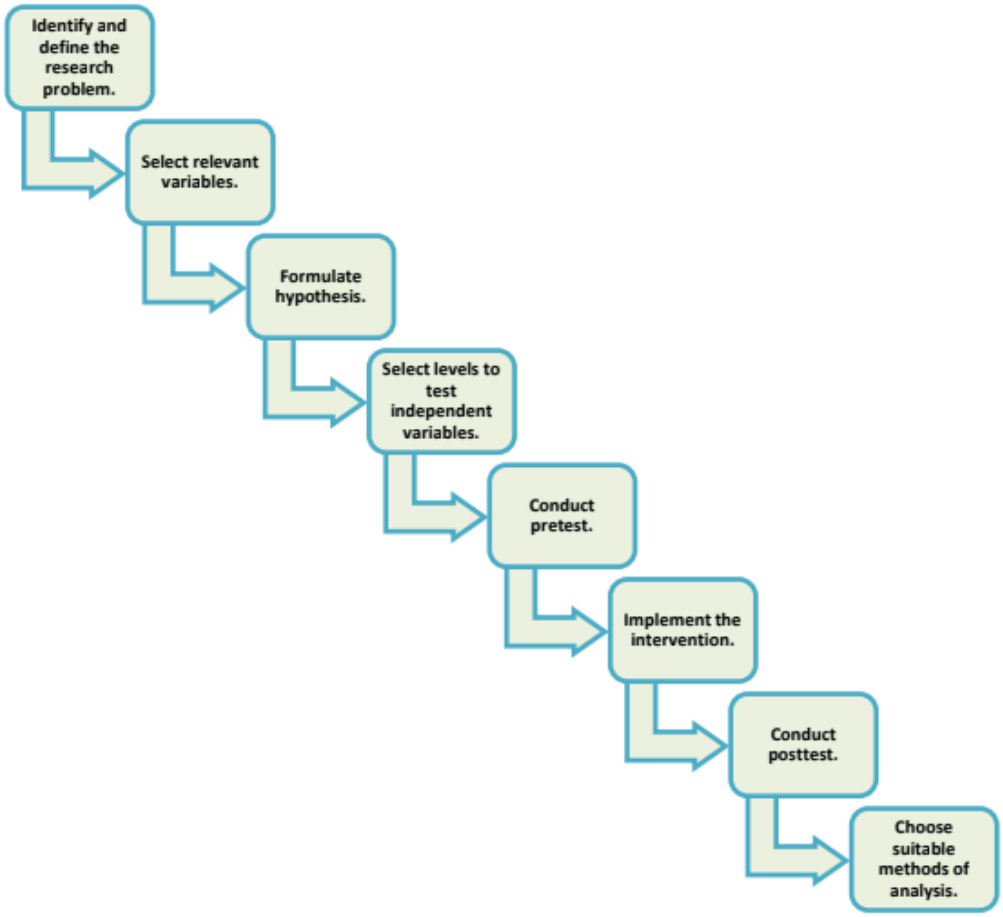

Figure 3.2 Procedure for conducting a quasi-experimental study

3.2.2 Formulate hypothesis

This research aimed to investigate "The impact of digital dialogue on conceptual understanding of high school students" to do this, three hypotheses were created based on the impact of digital dialogue on the conceptual understanding, motivation, and engagement of the participants after undergoing the experiment:

The study was followed by the following hypothesis and their corresponding null hypothesis,

H1: Digital dialogue can improve the teaching-learning process

Ho: The integration of digital dialogue has no impact on the teaching and learning process

H2: Digital dialogue will encourage learners to argue, give justifications, defend and reflect upon their understanding, and be involved in a constructive and shared learning process.

Ho: Digital dialogue has no impact on student's engagement and class participation.

H3: Digital dialogue will motivate even those students to participate who are usually shy and passive learners.

Ho: Digital dialogue has no impact on participants motivation and increase of interest in the teaching process.

3.2.3 Selection of relevant variables

The independent and dependent variables were identified as follows:

Independent variable: Digital Dialogue

Dependent variable: Conceptual understanding and active engagement

3.3 Research setting and method

In order to set up an environment for fair comparison Undergrad students of age 18-22 were equally distributed into two groups: control and experimental. A total of 78 students participated in the experiment both male and female. The experiment took place for a period

of 7 days where the same teacher taught both groups the same topics under different conditions. The experimental group was taught using digital dialogue (the screenshots of using digital dialogue in the classroom are attached below in figure 3.) while the control group was taught the same topic using the conventional method of teaching. Before using the digital dialogue app Talkwall a pretest questionnaire was given to both groups.

After the intervention when the topic was covered by both groups a post-test was conducted.

After the whole intervention, the students were provided with an engagement checklist to measure the engagement while using the app. The participants of the experimental group were also provided with an engagement, and feedback survey form to measure their performance. (the respective forms are attached in Appendix B and C)

Statistical analysis requires choosing the appropriate statistical test. Figure 3.3 shows how it's done.

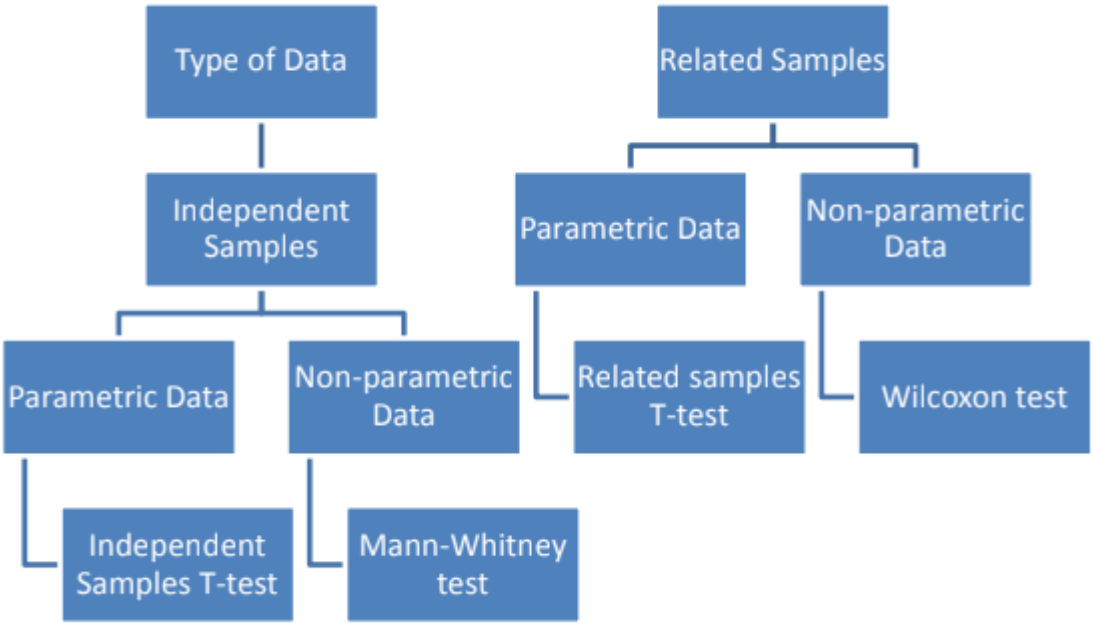

Figure 3.3 Which T-test to use
Image adopted from (Greasley,2007)

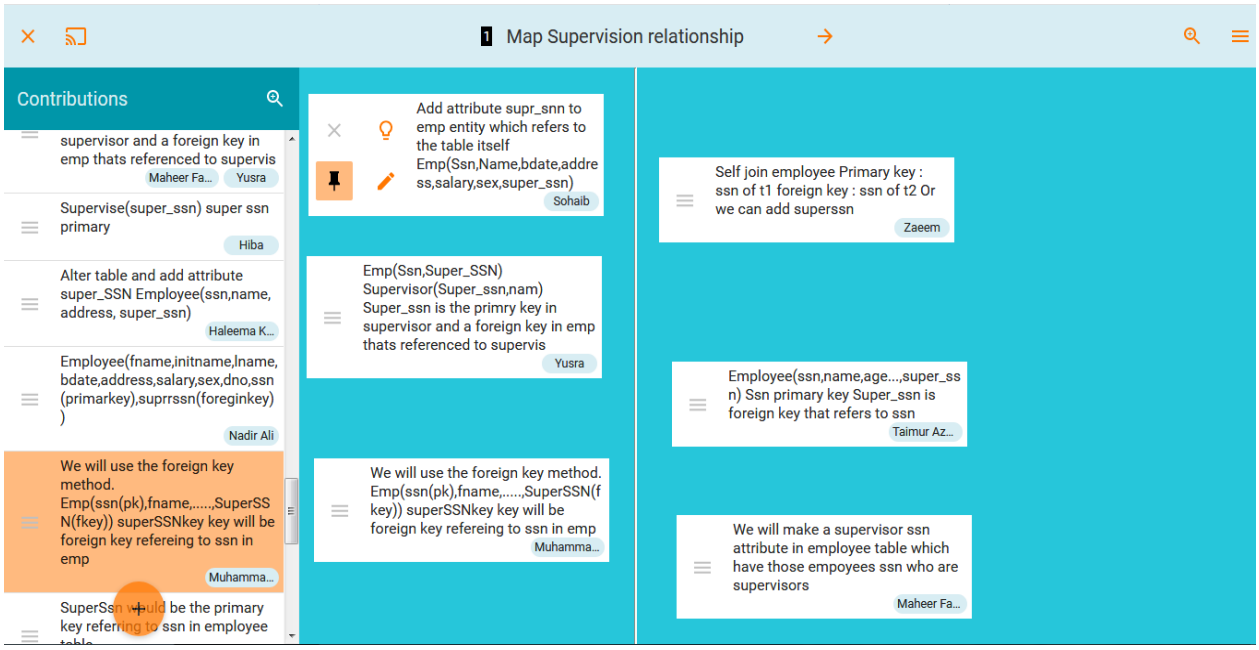

Figure 3.4 Talkwall in use

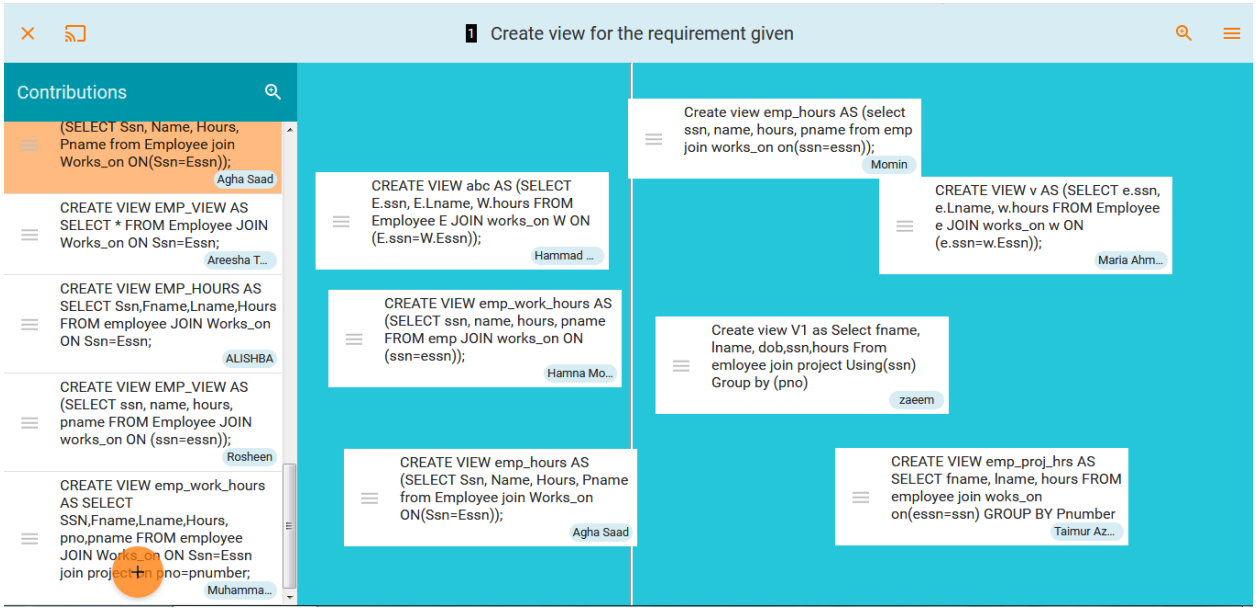

Figure 3.5 Talkwall in use example 2

3.4 Participants of the study

3.4.1 Teacher participant

The same teacher was assigned to teach both groups to ensure maximum control and similarity for both groups. The teacher was provided with brief details of the project intervention also she helped in reviewing the test tools, organizing both groups as well as making instructions for both groups.

3.4.2 Student participants

The student participants belong from the age group of 18-21 years from both genders and had just got enrolled in college. The average class size was from 35-40 with little or no knowledge of digital dialogue in advance.

3.4.3 Sampling

Convenience sampling technique was used to match the requirement of the experiment. Two groups of undergraduate students were selected on the basis of availability of these two groups. One was assessed as an experimental group that was supposed to undergo the intervention while the other one was taught using the conventional teaching method.

3.5 Description of research instruments

3.5.1 Pre and post-tests

The intervention took place in the undergrad class of views in SQL. where the pre and post tests were prepared based on the course content that was supposed to be taught during the experiment. The pre and post-test tools were created as 11 MCQs from the course content which was then evaluated and reviewed by two different teachers of SQL to check if they are good enough to check the conceptual understanding of students under study. The test is attached in Appendix A.

3.5.2 Student engagement form

To check the emotional, cognitive and behavioural engagement of the student, the student engagement checklist was prepared (Fredricks et al., 2004). To look for the emotional involvement of the students his/her interest level is assessed during the learning process. similarly, to check their cognitive engagement, they are assessed on the basis of their need or wish to learn more and enhance their understanding. The outcome of testing behavioural engagement is to see if the student shows interest in their learning process and participate actively in their learning process. This checklist is attached in Appendix C.

3.5.3 Student feedback form

To assess the motivation level of the participants a feedback survey form was prepared based on motivational design theories of John Keller's ARCS model (1987). 1) Attention 2) Relevance 3) Confidence 4) Satisfaction are enhanced. This form is attached in Appendix B.

3.5.4 Statistical Analysis

IBM SPSS for Mac was used to perform all the statistical analysis while the hypothesis was selected based on a 0.05 level of statistical significance. T-test for independent samples was used to find out any differences between the pretest and the post-test score of both groups.

CHAPTER 4: DATA ANALYSIS AND RESULTS

This chapter presents the quantitative analysis of data collected during and after the intervention. This study was an attempt to identify the impact of digital dialogue on motivation, engagement and conceptual understanding of students. A Quasi-experimental study was conducted. The pre-test post-test control and experimental group design was employed. Our goal is to find out if there is a significant difference in test scores between control and experimental groups after the intervention as compared to scores before.

4.1 Pre and post tests

To check the existing knowledge the participants in both groups were provided with a pre-test that comprised of a total of 11 questions. After taking the pre-test the experimental group was taught using digital dialogue while the control group was taught conventionally by the same instructor for a period of one week. At the end of the week, both groups were provided with the post-test questionnaire. Both tests were the same. The results of these tests are listed below.

A total of 39 participants were included in each group making it a total of 78 students

Table 4-1 The relevant aspects of pre-test of both: control and experimental groups including mean, median, standard deviation and skewness

	Group			Statistic	Std. Error
Pre-test marks	Control	Mean		6.2821	.23793
		95% Confidence Interval for Mean	Lower Bound	5.8004	
			Upper Bound	6.7637	
		5% Trimmed Mean		6.2578	
		Median		6.0000	
		Variance		2.208	
		Std. Deviation		1.48588	
		Minimum		4.00	
		Maximum		9.00	
		Range		5.00	
		Interquartile Range		2.00	
		Skewness		.500	.378
		Kurtosis		-.647	.741
	Experiment	Mean		6.1282	.25233

	95% Confidence Interval for Mean	Lower Bound	5.6174	
		Upper Bound	6.6390	
	5% Trimmed Mean		6.0584	
	Median		6.0000	
	Variance		2.483	
	Std. Deviation		1.57580	
	Minimum		4.00	
	Maximum		10.00	
	Range		6.00	
	Interquartile Range		2.00	
	Skewness		.586	.378
	Kurtosis		-.217	.741

As seen in the table above the pretest mean score for the experimental group (M=6.12, SD=1.57) as compared to the control group (M=6.28, SD=1.48). It can be seen that there is no significant difference between the scores of both groups, making it an ideal situation for a quasi-experiment.

Table 4-2 The relevant aspects of post-test of both: control and experimental groups including mean, median, standard deviation and skewness

	Group			Statistic	Std. Error
Post-test marks	Control	Mean		8.49	.307
		95% Confidence Interval for Mean	Lower Bound	7.87	
			Upper Bound	9.11	
		5% Trimmed Mean		8.60	
		Median		9.00	
		Variance		3.677	
		Std. Deviation		1.918	
		Minimum		4	
		Maximum		11	
		Range		7	
		Interquartile Range		3	
		Skewness		-.676	.378
		Kurtosis		-.175	.741
	Experiment	Mean		9.64	.185
		95% Confidence Interval for Mean	Lower Bound	9.27	
			Upper Bound	10.02	
		5% Trimmed Mean		9.71	

	Median	10.00	
	Variance	1.341	
	Std. Deviation	1.158	
	Minimum	6	
	Maximum	12	
	Range	6	
	Interquartile Range	1	
	Skewness	-.952	.378
	Kurtosis	1.876	.741

It can be observed that the mean score of posttests for experimental group is higher (M=9.64, SD=1.158) as compared to the control group (M=8.49, SD=1.918).

To further confirm if the difference is actually statistically significant, we first need to find the right test for significance depending on the data distribution.

4.2 Related vs independent sample

The study comprised of control and an experimental group that consisted of different sets of participants and scores (control and experimental) were provided by different people, making it an independent sample study.

While conducting an educational research sample can be mainly of two types

Related sample: When the data sets are obtained from the same people.

Independent sample: When the data sets are obtained from two different groups of people

4.3 Selection of statistical hypothesis test

To confirm if the results of the control group compared to the experimental group in post-test is significant or not, we have to perform a statistical hypothesis test with the null hypothesis that there is no significant difference in mean scores of both groups. As our data is independent sample one of these two tests can be conducted.

Independent two-sample t-test: when the data is normally distributed and both the data sets have the same variance.

Mann–Whitney–Wilcoxon test: when the data is not normally distributed (non-parametric).

4.4 Test for normality

To check for normality, the shape of the curve on histogram representing the distribution of data is compared to a normal bell curve, where most of the score lie around the centre of distribution (Field, 2013), in order to check if the data is normally distributed or not.

The two data sets of pre-tests, experimental and control group, scores are shown in figure 4.1 and 4.2 respectively.

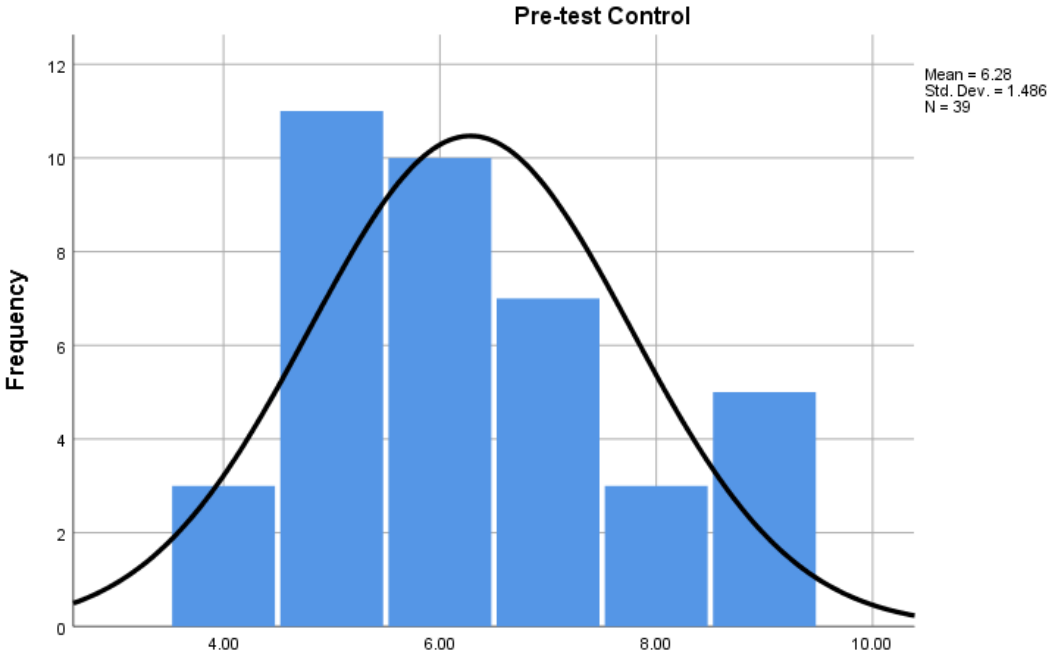

Figure 4.1 Pre-test control group histogram and normal distribution line

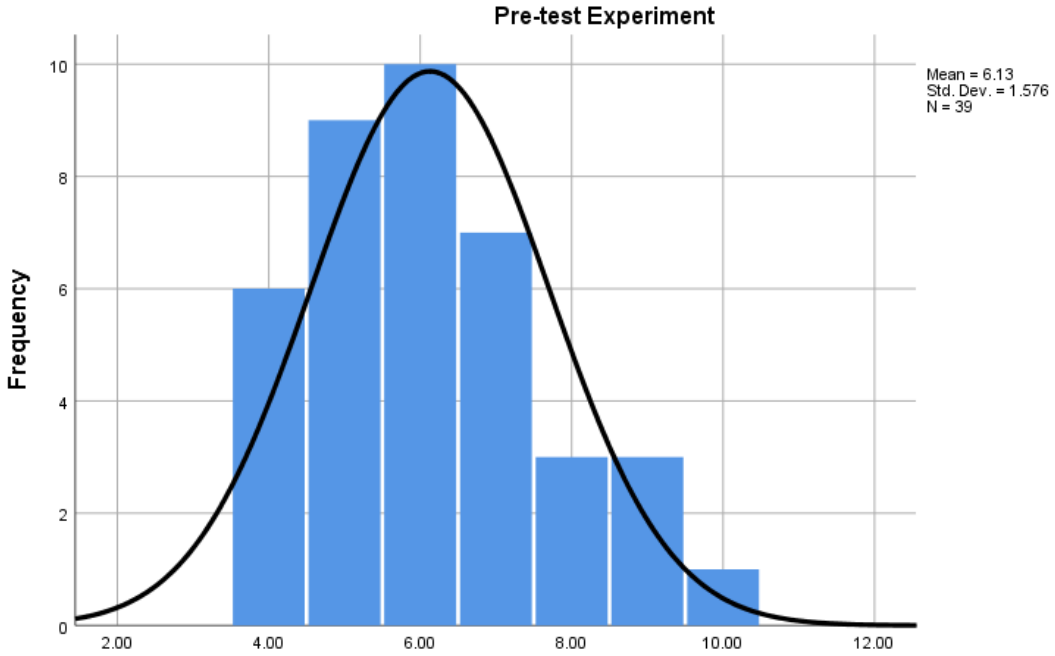

Figure 4.2 Pre-test experiment group histogram and normal distribution line

The two data sets of post-tests, experimental and control group, scores are shown in figure 4.3 and 4.4 respectively.

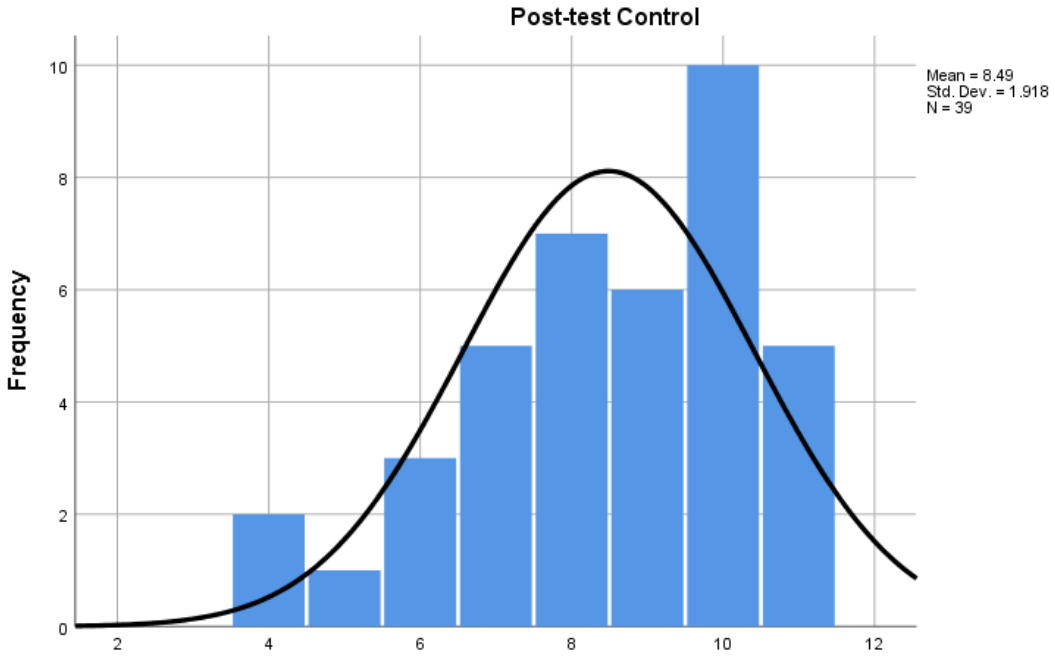

Figure 4.3 Post-test control group histogram and normal distribution line

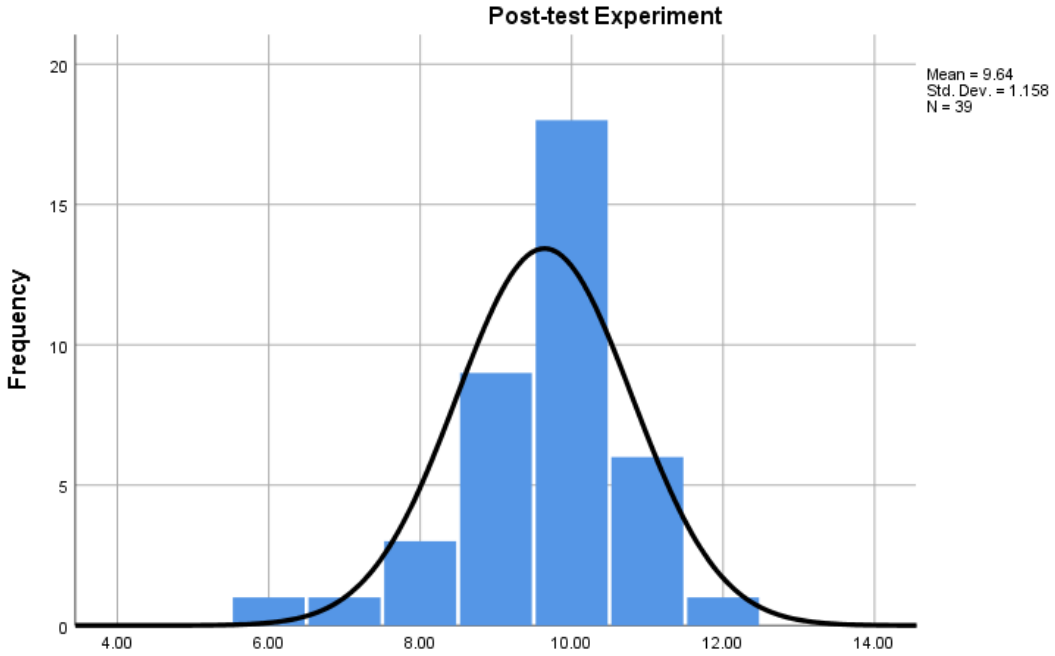

Figure 4.4 Post-test experiment group histogram and normal distribution line

We can see that our data is not normally distributed. However, this is not a very objective method to determine normality. Kolmogorov Simrnov (K-S) test and The Shapiro-Wilk (S-W) test can be used to check for normality of data distribution. For smaller ($1 < n < 2000$) datasets Shapiro-Wilk test is more accurate.

The results of Shapiro-Wilk test lie on the significance of P-value where if $P > 0.05$ then the data is assumed to be normally distributed and if $P < 0.05$ then data is not normally distributed (Field, 2013)

Null hypothesis: Population is normally distributed

W = 1 when sample-variable data are perfectly normal

For P-values (sig) <= 0.05: the null hypothesis is rejected

For P-values (sig) >= 0.05: the null hypothesis has failed to reject

Table 4-3 Results for normality conducted in SPSS for pretest and post-test

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test marks	Control	.191	39	.001	.906	39	.003
	Experiment	.173	39	.005	.926	39	.013
Post-test marks	Control	.170	39	.006	.921	39	.010
	Experiment	.263	39	.000	.884	39	.001

As evident by the test results of the Kolmogorov Simrnov and Shapiro-Wilk tests $P < 0.05$ for all cases, Therefore, it can be concluded that the null hypothesis is rejected and the data is not normally distributed.

4.5 Analysis of pre and post test data scores

For comparison of the data of two independent groups, that are proved to be non-parametric two tests can be performed, that are Mann-Whitney test and the Wilcoxon Rank-sum test.

The Mann-Whitney test

It is performed for analysis of independent data sample that is obtained from two different groups. It is mainly used for looking for differences in groups in ranked positions of the scores (Field, 2013)

The results of these two tests for pre-test and post-test scores are listed in the tables below:

Table 4-4 Result of Mann-Whitney test

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Pre-test marks is the same across categories of Group.	Independent-Samples Mann-Whitney U Test	.635	Retain the null hypothesis.
2	The distribution of Post-test marks is the same across categories of Group.	Independent-Samples Mann-Whitney U Test	.006	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .050.

Table 4-5 Rank table for pre and post test scores

Ranks

	Group	N	Mean Rank	Sum of Ranks
Pre-test marks	Control	39	40.69	1587.00
	Experiment	39	38.31	1494.00
	Total	78		
Post-test marks	Control	39	32.71	1275.50
	Experiment	39	46.29	1805.50
	Total	78		

Table 4-6 Mann-Whitney and Wilcoxon tests statistics

Test Statistics

	Pre-test marks	Post-test marks
Mann-Whitney U	714.000	495.500
Wilcoxon W	1494.000	1275.500
Z	-.475	-2.730
Asymp. Sig. (2-tailed)	.635	.006

From the tables above it can be concluded that there is no significant difference in mean score of control group (M=6.28) and experimental group (M=6.12) for pre-test. Whereas difference in mean score of control (M=8.49) and experimental (M=9.64) groups for the post-test is significant.

4.6 Analysis of student engagement observation checklist

To Analyze behavioral, emotional and cognitive engagement of the students, an engagement observation list was used. This observation list is attached in Appendix D and the corresponding results are represented below in charts.

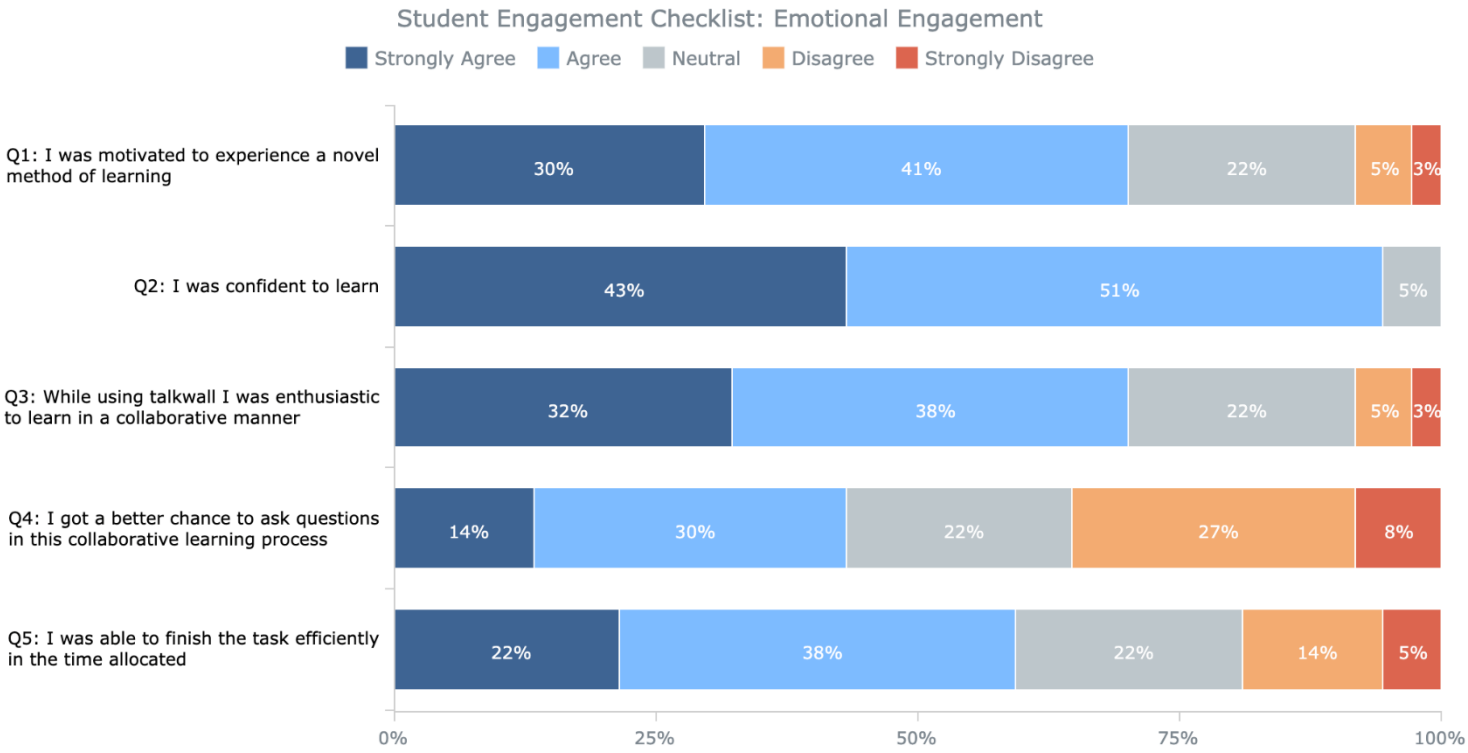

Figure 4.5 Student engagement checklist: Emotional engagement response distribution

The results related to emotional engagement show students were influenced positively and they were better motivated (Q1, Q2). Also, they were able to complete their task efficiently (Q5). Students appreciated how they were provided with better and equal opportunities to participate actively (Q3, Q4).

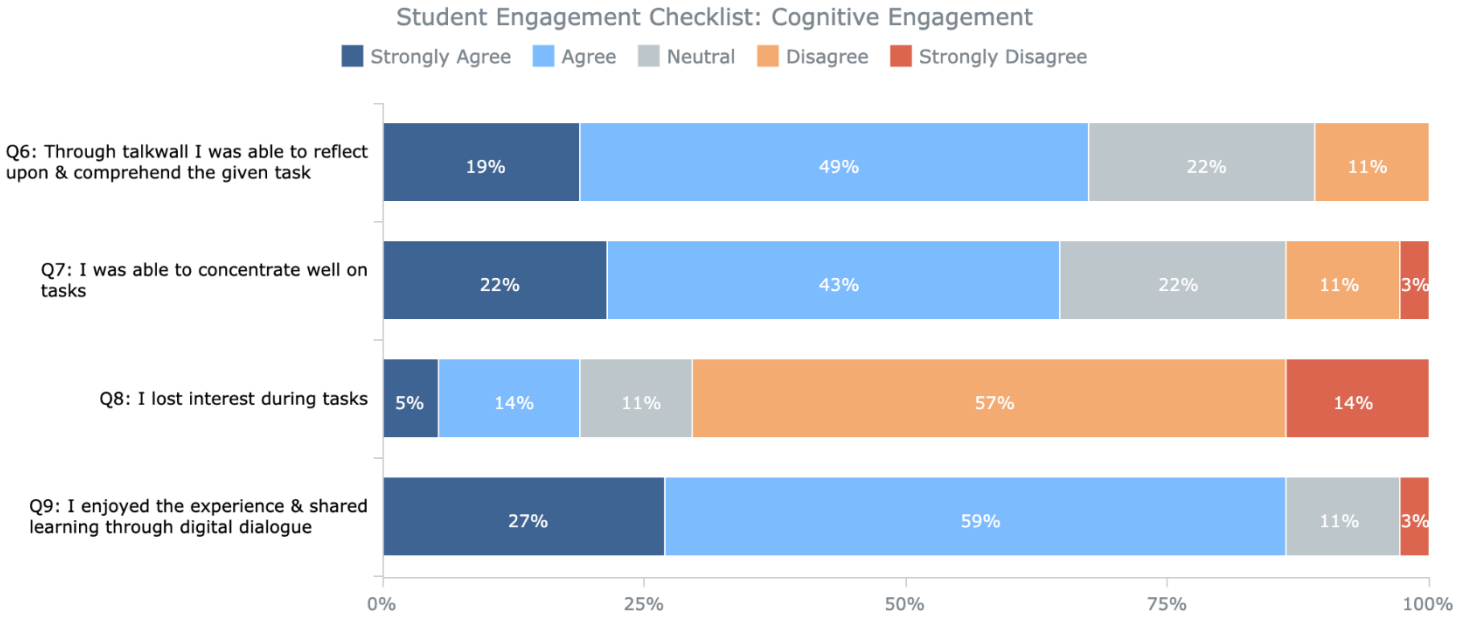

Figure 4.6 Student engagement checklist: Cognitive engagement response distribution

The students displayed a major increase in their cognitive activity and responded positively about their interest (Q6, Q7) they were better able to focus verbally and visually (Q8, Q9) which resulted in an overall better concentration on the task.

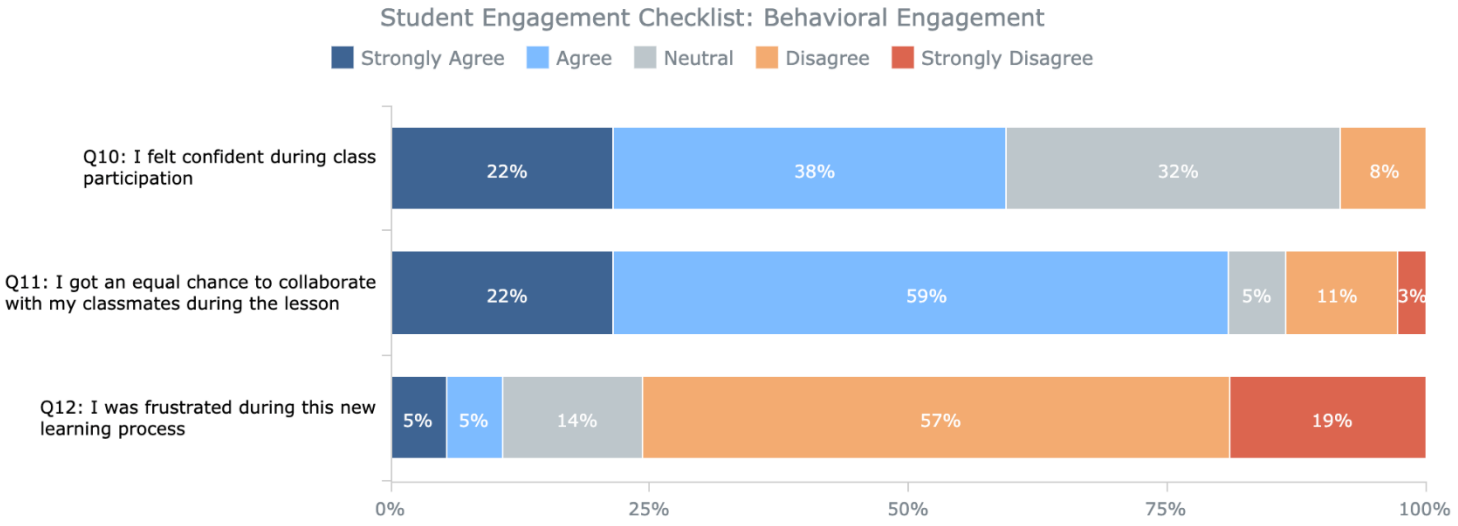

Figure 4.7 Student engagement checklist: Behavioral engagement response distribution

As it is evident in the charts most of the students responded positively and showed improved behaviour while using digital dialogue as a pedagogical tool (Q10, Q11).

4.7 Analysis of student feedback form to assess student motivation

The ARCS model of (Keller, 1987) was used for the creation of feedback from including four main components: Relevance, confidence, attention and satisfaction. The form was a Likert scale checklist provided to the participants of the experimental group.

To test the reliability, Cronbach's Alpha test was used for the Likert scale questionnaire of feedback checklist. The results of these tests are given below in table 24

Table 4-7 Result of Cronbach's alpha test

Reliability Statistics

Cronbach's Alpha	N of Items	Internal consistency
.761	9	Acceptable

Table 4-8 Result of Cronbach's alpha test per question

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	29.6757	22.781	.428	.742
Q2	27.6757	23.947	.496	.732
Q3	28.5676	22.419	.550	.721
Q4	28.2162	21.341	.630	.706
Q5	28.0541	22.108	.681	.704
Q6	27.5135	27.423	.045	.795
Q7	27.2973	26.659	.234	.764
Q8	28.2162	21.785	.498	.730
Q9	27.9730	23.194	.452	.737

The score that was yield as a result of performing Cronbach's Alpha test is 0.761 which allows us to accept the questionnaire for its validity. The results of the feedback questionnaire are represented in the following charts more precisely.

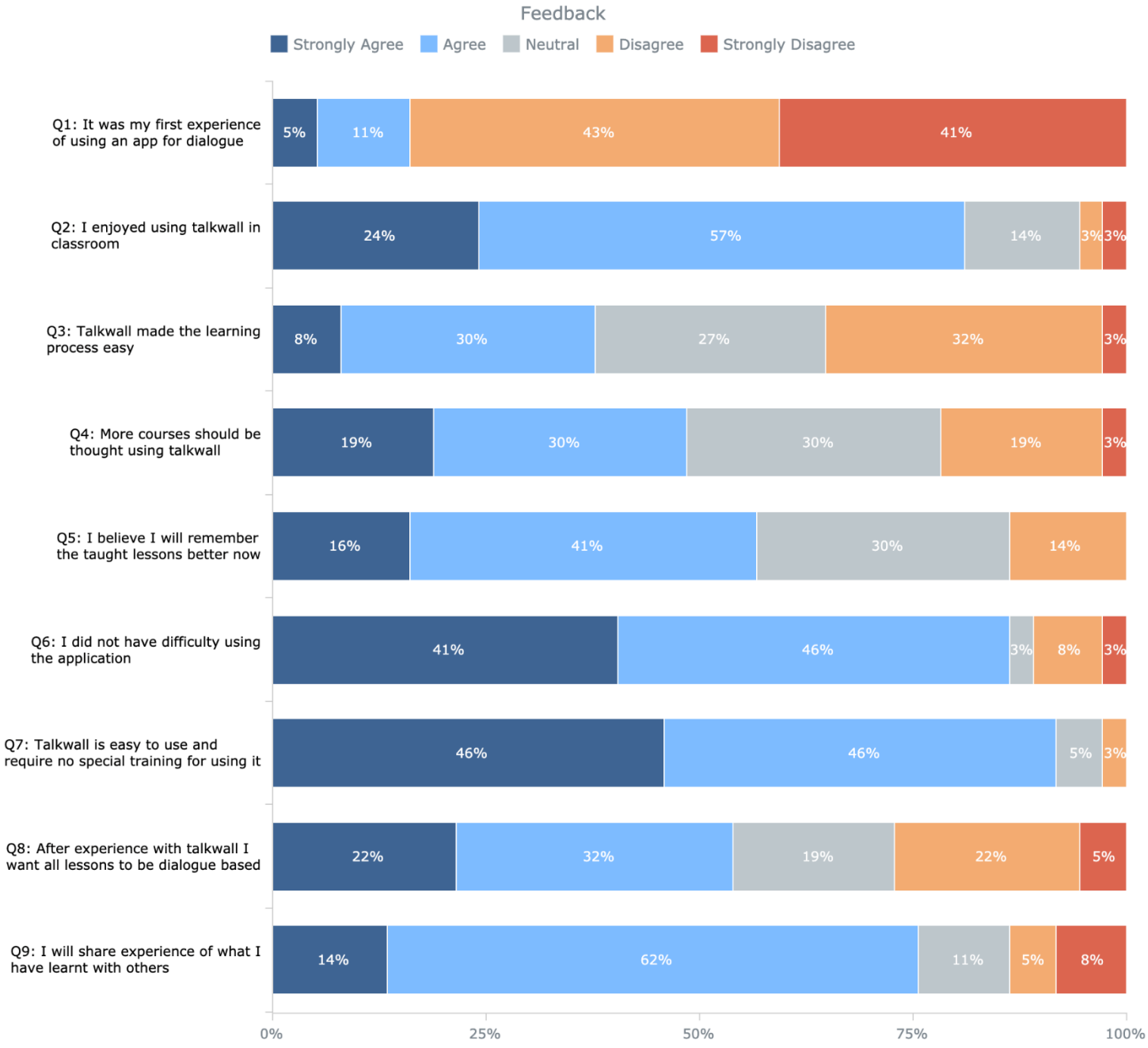

Figure 4.8 Feedback form response distribution

The first three questions were based on the component of attention where the students responded very positively in order to show how this new method of learning was easy and fun for them (Q2, Q3)

Question 4 and 5 were based on the relevance of the digital dialogue with classroom activities and the response of the majority of students was seen to be positive in order to using digital dialogue as a pedagogical tool in classroom activity.

To evaluate the confidence of students' questions 6 and 7 are designed based on their ability and willingness to use digital dialogue in their learning process and majority of students said they were confident enough to use it without any help or assistance.

The overall results of the feedback form were observed to be positive and the students were more satisfied and confident about what they have learnt. They also wanted to use this method for other subjects (Q8)

Some of the descriptive responses of the participants of the study are mentioned below which were collected at the end of the intervention giving us a clear picture of how the new pedagogical method of digital dialogue was appreciated by students.

"It was helpful because various answers were shared on a single portal giving insights on their comprehension of the topic. Teacher pinning the best answers help us to look at the most appropriate view."

"It increases collaboration and gave all of us equal chance to participate."

"I think it was very helpful and fun at the same time, this technique must be introduced in other courses."

"It is a good practice and must be conducted more often."

"The experience was amazing. I liked the fact that you can see every student on a question."

"One thing that I like the most was that digital dialogue encourages group learning."

"My favorite feature is that one can edit and improve also we can review each other's responses."

CHAPTER 5: DISCUSSION

The aim of this research was to evaluate digital dialogue as a pedagogical tool and how it can be used to enhance learning outcomes such as conceptual understanding, motivation, and engagement. In this chapter the findings of the study will be discussed in detail.

5.1 Impact of digital dialogue on conceptual understanding

Null Hypothesis: Digital dialogue has no impact on the conceptual understanding of high school students.

Depending on the mean score of pre-test of both groups, that was (M=6.12) for the experimental group and (M=6.28) for the control group, it can be clearly concluded that both groups had the same level of understanding as there is no significant difference in the mean score before the intervention which provided the researcher with a safe ground for performing the intervention using a Quasi-experimental method.

The aim of performing this test was to check the conceptual understanding as the highest marks on pretest were observed to be low. The results of pre-test suggest that there is a need for a good pedagogical tool that can be used as a logical approach to making their understanding clear.

However, the post-test results of the experimental group presented a significant difference. The experimental group was taught using digital dialogue technique. during the lecture, the instructor used a social media app "Talkwall" when needed. The mean score of Post-test for the experimental group was (M=9.64) whereas the mean score of the control group was (M=8.49) as it's evident from the mean score of results of experimental group has increased significantly based on statics. Hence providing us with a reason for rejecting the Null Hypothesis. Also, it encouraged the researcher about the advantage of digital dialogue.

Moreover, the use of digital dialogue supported active participation even for those students who are usually shy and passive learners. It also allows the student to learn at their own pace. The results of this experiment are a clear indication of the positive impact of digital dialogue as a pedagogical tool.

5.2 Impact of digital dialogue on student engagement

Null Hypothesis: Digital dialogue has no impact on students' engagement and class participation

Based on the results of the engagement checklist it is safe to reject the Null Hypothesis as a clear increase in class participation was seen by the researcher as well as the instructor during the intervention. The students discussed the content of the application with their class fellows and were able to relate many aspects of this new teaching method with prior knowledge. Through the use of open dialogic space, everybody got an equal chance of sharing their knowledge.

This open dialogue method encouraged all the participants to argue, give justifications, defend and reflect upon their understanding, and be involved in a constructive and shared learning process.

The fact that learning through dialogue is a two-way process where the instructor is not the only one to deliver the lecture, despite it allows all the participants to increase each other's knowledge by sharing their views or by questioning the other person's information which results in a better understanding of the concepts under study.

5.3 Impact on motivation

Null Hypothesis: Digital dialogue has no impact on participant's motivation and increase of interest in the teaching-learning process.

Based on the results of motivation level of students discussed in the previous chapter it can be clearly stated that the null hypothesis is rejected as there is a high level of motivation seen in the participants of the experimental group.

The process of learning through dialogue boosted their confidence level because all of them were provided with an equal chance of class participation and sharing their knowledge. Even the passive learners were reported to be more active as evident in the results. The participants

loved the concept of shared learning which provided them with an open space for taking charge of their own learning process.

5.4 Feedback and observation

Every learner has their own knowledge acquisition needs and has their own pace of learning. By a combination of current trends in teaching and benefits of practical strategies of teaching digital dialogue, teaching can be developed to make teaching style even more effective. To meet the learning style of every individual different strategy should be incorporated in the traditional classroom to cope with this ongoing change in learning mode. It comes in handy to use shared educational resources to lessen the gap of learning for fast and slow learners because a shared learning platform enables the students to think creatively and rationally and motivate them to participate more actively in their learning activities.

Traditional methods of teaching cannot be fully replaced with digital teaching but digital teaching can make learners happy by integrating more creative methods effectively in teaching and this is how it can have the best teaching effect.

The digital dialogue method of teaching was observed to have multiple strengths:

1. No problem in learning

   Digital dialogue gives comfort to students in the context of space and time which is not given in traditional mode of learning thus omitting any kind of pressure or hurdle that the student might feel otherwise

2. Rich knowledge acquisition

   By the process of shared learning and availability of adequate online resources the learner not only learns what the instructor delivers but also, they get a chance to learn from each other beyond the curriculum material which enhances learning effect.

3. Tailored learning schedule and content

In traditional teaching technique, all learners are treated equally regardless of their level of learning. While digital dialogue provides the teachers and students to come up with creative and more inclusive ways of learning and teaching to satisfy the learning needs of each individual.

4. Complete records of learners

   Talkwall was used as a digital tool for scaffolding dialogic teaching, it allows all the participants and instructors to keep a complete record of the class discussion as well as the lecture and all the information that is being shared in the class that could also be used later. it also works as an effective way of collecting knowledge for students.

5. Interactive learning

   For better communication and understanding between teacher and student, digital dialogue works like a chat room where they can share their knowledge or ask questions wherever and whenever they want

6. Enhancement of learning interests.

   Through digital dialogue, instructions are more clear and lively and learning can be made more efficient by the presence of media. It also promotes learning persistence in learners

It can be concluded that digital dialogue makes learning easier and successful by including an open space for discussion and allowing students to take charge of their own learning process. digital dialogue makes learning attractive and provides the learners with comfort by breaking the restriction of space and time. Attention is increased by learning motivation and it allows absorption of new knowledge.

Higher learning outcomes will be presented by the students who have high motivation for learning (Sahbaz, 2012)

5.5 Limitations

the overall results of the study show a positive effect of digital dialogue. However, the study contained a number of Limitations that are important to mention:

1. Technology adoption barrier

   In the beginning the instructor and students were not comfortable with new technology and its use

2. Limited time for the intervention

   The time allotted for the intervention was limited. due to this time constraint, only two topics were covered during the intervention, while a more comprehensive study conducted in greater detail should include more topics so that a better stronger conclusion can be made about the impact of digital dialogue

   A similar study should also be conducted with a larger population of different age and schools for more holistic evidence of the positive impact of digital dialogue

3. Availability of a well-trained instructor:

   As the lesson was mainly taught by the instructor who had no prior training or experience in digital dialogue. it might be assumed that her personal skill of adapting to the new technique may also have affected the overall result of the experiment.

CHAPTER 6: CONCLUSION

Communication is the fundamental key of teaching whether it aims to make students able to gain a better conceptual understanding of things or to promote social as well as intellectual exploration for the sake of it. Nevertheless, within the professional practices and literature, there is known to be a considerable variation to which dialogic teaching is viewed as highly important. Great stress has been put over the need of student participation by most of the professional literature, it also focuses on collaborative work, and clarifies objectives for the students. However, in the classroom setting, dialogic teaching has made learning in science very easy and innovative as it incorporates different perspectives of learning that is demanded by today's learner to satisfy their learning needs which play an immensely significant role in the enhancement of building their confidence and satisfaction. Here, including students' participation is not only what dialogic teaching consist of, but it is also considered to be a method through which everyday views and perspectives are replaced with disciplinary views. Dialog in the classroom help students learn how to give respect to the perspectives as well as experiences of other students which plays an important role in developing a sense of responsibility and brings in positive outcomes where various views and perspectives can be shared.

The overall focus of this study was to evaluate the effectiveness of dialogue supported by technology as a pedagogical tool to enhance the conceptual understanding of students. Also, it was aimed to test their motivation, engagement and academic achievement.

The previous research has emphasized on the need of a more inclusive and shared learning process also it recommends the need for incorporating more creative and inclusive latest technological tools in the teaching-learning process to match the learning needs of 21st-century learners. As the conventional teaching mode seems redundant and boring to most students, they lack interest in the overall classroom activity. The use of digital dialogue can greatly increase the level of understanding and logical reasoning of students as well as it is a great way to actively involve them in their learning process which as a result can increase their understanding and boost their confidence.

To conduct the Experiment a Quasi-experimental method was used to investigate the potential impact of digital dialogue on conceptual understanding. In the first phase of study previous knowledge of the participants was tested using a pre-test tool. In the second phase, the experimental group was taught using digital dialogue while the control group was taught in the conventional manner after which post-test data was collected. In the third stage of the experiment, the data was analyzed for results and a significant increase of post-test score of the experimental group was found.

The null hypothesis was rejected and the alternative hypothesis was failed to reject, and thus student's engagement level, and logical reasoning were seen to be enhanced. It was concluded that digital dialogue as a tool for pedagogical activity can positively influence the learning abilities of students.

CHAPTER 7: RECOMMENDATION

The dialogue's form that has been occurring in the classrooms for at least two millennials is spotlighted as critically important for learning as well as teaching. Moreover, about optimal forms various hypotheses have been proposed; the need for asking questions and taking charge of their own learning by the students has been highlighted as a positive change by many researchers and scholars along with the student's extended response which involves justification optimally. Better learning opportunities and satisfied students come up as individuals that bring social growth as they are more aware of their responsibilities and are confident enough to participate in the economic growth of the country as well. Dialogue in class is beneficial to the students because it is not just simple talk rather it involves a number of other things where there are discussions, articulations of ideas as well as competing viewpoints' also it results in evaluation; and accepting differences' and a gradual resolution in a very productive direction. The study concludes that there is a very positive impact of dialogues on students' learning. Talkwall as a supportive tool was used in the study which is a cloud-based tool that allows classes to share, evaluate and develop knowledge together. For example, teachers can use the service to propose questions or tasks and students can respond, either individually or in a group basis, posting messages to a whiteboard or projector in the classroom. Each learner is allowed by it to build a strong connection with the content also they get to think over various concepts, Students seem to be in quite an active role when it comes to using technology as a tool to communicate with other students and teachers. They do not seem to be in a passive role, they get a chance to actively think and select pathways in order to produce, collect, manipulate as well as expose data/information. As far as the use of technology in dialogic teaching is concerned, it makes students able to think with regard to knowledge and by utilizing skills they help them select things which are usually not possible in typical classrooms led by instructors. Students become able to define what their goals and aims are and it also helps them in taking decisions since technology is used by them as a tool for getting help in authentic tasks' performance. The progress of students is also assessed by themselves as well as by their peers making them more independent and self-motivated learners.

General recommendations

This research work was based on evaluating the impact of digital dialogue on conceptual understanding, engagement and motivation of high school science students. The aim of this study was to bring back student's interest and motivation in the classroom activity. The results of the study support the stance of using innovative and more exclusive teaching pedagogies like digital dialogue in teaching learning also it focuses on the need of embedding latest technology that will help enhance learning outcomes. The study focuses on the need for better learning opportunities to satisfy the learning needs of today's learners. The policy makers and departments of education should take charge of bringing in tools and techniques that are the demand of 21st century learners to help institutes to improve their teaching pedagogies. A great way to encourage other parties that are involved in education is to publish positive outcomes of such initiatives. Also, seminars and conferences should be held on national and international level to appreciate those who come up with innovative and inclusive ways of teaching, this will appreciate those who have already taken the initiative and will encourage those who are hesitant to accept change. These workshops will also inform and educate everyone about the latest developments in educational technology and modes of learning where national and international level educationalists will get a chance to share their experiences and learn from each other. Educational policy makers need to invest in better technological supply and need to change the curriculum to a more skill-based content where learner can relate and apply their knowledge in practical life.

Future recommendations

Digital dialogue based on previous research has a lot of scope for future research as a tool for incorporating innovative and inclusive pedagogies in classroom setting.

1. To take better outcomes of classroom dialogic pedagogies better technological resources like Talkwall must be created and used. Teachers and other educational experts must be involved in the process of the creation of tools to achieve better learning outcomes.
2. Taking in view the crucial importance of dialogue in the classroom and its impact on the learning capabilities of students, it is necessary to properly train the instructors

accordingly, and incorporate dialogic pedagogies in their routine teaching methods so that they will be better able to involve all the students in a better dialogue and take full advantage of this new concept towards learning. As far as the teacher's professional development is concerned, there is a need to take two important steps in this regard which include increasing funds along with quality policies which are necessary. In such a way, various tools and immense knowledge will be possessed by teachers in order to lead students through dialogic teaching.

3. Public and private education organizations have a tradition of dictating students and these are places where students' learning is as preset schedule. But there are many organizations today that are working towards the promotion of more inclusive and creative ways of learning to enhance student's learning, these organizations need to be supported by the government through many channels today, many advocates, organizations, as well as education leaders, have discredited the traditional system by arguing that there can be learning anywhere anytime without any limitation. There should be redesigning of learning environment that can be helpful for students as they would be able to easily understand various concepts anywhere, at any place and at any time.
4. With this rapid advancement of educational technology tools available in the market, schools have a hard time getting them to take an interest in their learning. in order to provide students with a better learning experience in a digital dialogue based classroom it will be of great advantage to provide them with the latest technology and better internet connectivity to create a well-managed classroom environment where all of them can face each other and make direct eye contact during dialog and get a chance to be heard equally.
5. Policymakers, as well as schools, shall be provided with funds and resources in order to make dialogic teaching common in the schools which would also include the teachers' training in this regard. As arranging training sessions would help them learn more about dialogic teaching that they can implement in the classrooms later in order to enhance the students' learning.
6. When it comes to implications behind the introduction of a dialogic approach it is very important to explore that in the classroom. The government should take initiative to

explore as well as introduce the best practices with regard to dialogic teaching in the settings of a classroom. It is imperative to conduct research on the classroom processes that how can it play a significant role in supporting dialogic practices. Especially, we ought to be aware of the impact of these dialogic approaches on students' learning and conceptual understanding since it would be helpful in knowing that what can be and what cannot be achieved through collaborative work in groups.

7. In order to promote the dialogic engagement in the classrooms, there is a need to introduce the professional and personal development strategies which can help and support teachers in order to bring changes in teaching as they would replace monologic teaching with dialogic teaching.
8. To promote dilogic technique in class It is imperative to design such courses which would play their critically important role in promoting reflective as well as critical thinking practice since they would engage in enquiry's communities and pupil's examination through facilitating skills and questioning teachers.
9. A more detailed and longitudinal research including more topics and subjects must be done using the pedagogy of digital dialogue to see its long-term effects.

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APPENDICES

Appendix A: Pre and Post Test

1) From mapping an ERD to relational schema, entity types are mapped to:
   a) Entities
   b) Relation
   c) Relationship
   d) Keys

2) In the SQL language, the _____ statement is used to make table definitions.
   a) Create session
   b) Create table
   c) Create index
   d) Select

3) A candidate key must satisfy all the following conditions except:
   a) The key must uniquely identify the row
   b) The key must indicate the row's position in the table
   c) The key must be nonredundant
   d) Each nonkey attribute is functionally dependent upon it

4) Which of the following is the most appropriate method to map M:N relationship in relational schema:
   a) Cross reference method
   b) Relationship relation
   c) Associative entity
   d) All of the above

5) The type of relationship between strong and weak entity type is called:
   a) Identifying relationship
   b) Non-identifying relationship
   c) Binary relationship
   d) Recursive relationship

6) A weak entity type has a special type of identifier which is known as
   a) Primary key
   b) Partial key
   c) Composite key
   d) None of the above

7) Which of the following statement is true?
   a) Views could be looked as an additional layer on the table which enables us to protect intricate or sensitive data based upon our needs
   b) Views are virtual tables that are compiled at run time
   c) None of the above
   d) Both a and b

8) Create View v1 AS (Select EmpNo from Employee where salary=10000) is a type of:
   a) System Defined View
   b) Materialized View
   c) Simple View
   d) Complex View

9) You can delete a view with _____ command.
   a) DROP VIEW
   b) DELETE VIEW
   c) REMOVE VIEW
   d) TRUNCATE VIEW

10) What is a view?

a) A view is a special stored procedure executed when certain event occurs
b) A view is a virtual table which results of executing a pre-compiled query
c) A view is a database diagram
d) None of the Mentioned

11) Syntax for creating views is
a) CREATE VIEW AS SELECT
b) CREATE VIEW AS UPDATE
c) DROP VIEW AS SELECT
d) CREATE VIEW AS UPDATE

12) In MySQL view is said to be updateable, if the view definition contains ____ clause.

Appendix B: Feedback form

Questions	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. It was my first experience of using an app for dialogue					
2. I enjoyed using Talkwall in classroom					
3. Talkwall made the learning process easy					
4. More courses should be thought using Talkwall					
5. I believe I will remember the taught lessons better now					
6. I did not have difficulty using the application					
7. Talkwall is easy to use and require no special training for using it					
8. After experience with Talkwall I want all lessons to be dialogue based					
9. I will share experience of what I have learnt with others					

How was experience with Talkwall? What do you think can be improved? What feature did you like the most?

Appendix C: Engagement observation checklist

Questions	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Emotional Engagement					
1. I was motivated to experience a novel method of learning					
2. I was confident to learn					
3. While using Talkwall I was enthusiastic to learn in a collaborative manner					
4. I got a better chance to ask questions in this collaborative learning process					
5. I was able to finish the task efficiently in the time allocated					
Cognitive Engagement					
6. Through Talkwall I was able to reflect upon & comprehend the given task					
7. I was able to concentrate well on tasks					
8. I lost interest during tasks					
9. I enjoyed the experience & shared learning through digital dialogue					
Behavioral Engagement					
10. I felt confident during class participation					
11. I got an equal chance to collaborate with my classmates during the lesson					
12. I was frustrated during this new learning process					

What is your opinion on dialogue-based learning in class room?

Appendix D: Usability test

Questions	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. I think that I would like to use Talkwall more frequently					
2. I found Talkwall unnecessarily complex					
3. I thought Talkwall was easy to use					
4. I think that I would need the support of a technical person to be able to use Talkwall					
5. I found various functions in Talkwall were well integrated					
6. I thought there were too was too much inconsistency in the app					
7. I would imagine that most people would learn to use Talkwall very quickly					
8. I found this application very cumbersome/awkward to use					
9. I felt very confident using Talkwall					
10. I needed to learn a lot of things before I could get going with Talkwall					

Appendix E: Student Feedback Results

It was my first experience of using an app for dialogue

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	15	40.5	40.5	40.5
	Disagree	16	43.2	43.2	83.8
	Agree	4	10.8	10.8	94.6
	Strongly Agree	2	5.4	5.4	100.0
	Total	37	100.0	100.0	

I enjoyed using Talkwall in classroom

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	2.7	2.7	2.7
	Disagree	1	2.7	2.7	5.4
	Not Sure	5	13.5	13.5	18.9
	Agree	21	56.8	56.8	75.7
	Strongly Agree	9	24.3	24.3	100.0
	Total	37	100.0	100.0	

Talkwall made the learning process easy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	2.7	2.7	2.7
	Disagree	12	32.4	32.4	35.1
	Not Sure	10	27.0	27.0	62.2
	Agree	11	29.7	29.7	91.9
	Strongly Agree	3	8.1	8.1	100.0
	Total	37	100.0	100.0	

More courses should be thought using talkwall

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	2.7	2.7	2.7
	Disagree	7	18.9	18.9	21.6
	Not Sure	11	29.7	29.7	51.4
	Agree	11	29.7	29.7	81.1
	Strongly Agree	7	18.9	18.9	100.0
	Total	37	100.0	100.0	

I believe I will remember the taught lessons better now

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	5	13.5	13.5	13.5
	Not Sure	11	29.7	29.7	43.2
	Agree	15	40.5	40.5	83.8
	Strongly Agree	6	16.2	16.2	100.0
	Total	37	100.0	100.0	

I did not have difficulty using the application

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	2.7	2.7	2.7
	Disagree	3	8.1	8.1	10.8
	Not Sure	1	2.7	2.7	13.5
	Agree	17	45.9	45.9	59.5
	Strongly Agree	15	40.5	40.5	100.0
	Total	37	100.0	100.0	

Talkwall is easy to use and require no special training for using it

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	2.7	2.7	2.7
	Not Sure	2	5.4	5.4	8.1
	Agree	17	45.9	45.9	54.1
	Strongly Agree	17	45.9	45.9	100.0
	Total	37	100.0	100.0	

After experience with Talkwall I want all lessons to be dialogue based

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	5.4	5.4	5.4
	Disagree	8	21.6	21.6	27.0
	Not Sure	7	18.9	18.9	45.9
	Agree	12	32.4	32.4	78.4
	Strongly Agree	8	21.6	21.6	100.0
	Total	37	100.0	100.0	

I will share experience of what I have learnt with others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	8.1	8.1	8.1
	Disagree	2	5.4	5.4	13.5
	Not Sure	4	10.8	10.8	24.3
	Agree	23	62.2	62.2	86.5
	Strongly Agree	5	13.5	13.5	100.0
	Total	37	100.0	100.0	