p- ISSN: 2708-2113 e-ISSN: 2708-3608 L-ISSN: 2708-2113 URL: http://dx.doi.org/10.31703/gesr.2021(VI-III).09

Vol. VI, No. III (Summer 2021) Pages: 79– 88 DOI: 10.31703/gesr.2021(VI-III).09

Citation: Ihsan, A., & Qaisar, S. (2021). The Effect of Digital Pedagogy in Science Classroom as an Innovative Approach for Students Learning at Elementary Level. *Global Educational Studies Review*, *VI*(III), 79-88. https://doi.org/10.31703/gesr.2021(VI-III).09

The Effect of Digital Pedagogy in Science Classroom as an Innovative Approach for Students Learning at Elementary Level

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Abstract: *The paradigm shift of learning in the digital age requires teachers to adapt their classrooms in a technology-supported environment. This research study is intended to investigate the viability of digital pedagogy lessons at the elementary level. A qualitative case-study approach has been adopted to explore the effects on students learning and their attitude towards science. The 7th class of a public elementary school from District Kasur was selected. The topic of "Water" from the recommended curriculum of science was taught with an intervention. Data was collected through recorded video observations, and classroom discourse was analyzed to explore the productive potential of digital pedagogy lessons for the elementary level Science class. The research findings propose to use digital tools in the classroom for productive and quality learning specifically to enhance the quality of teaching-learning with minimal resources in developing countries that are facing critique for providing the low quality of education.*

Key Words: Related Services, Incentives, Four Disabilities, Parental Perception

Introduction

Deteriorating the quality of education in Pakistan, specifically low quality of science education, needs to introduce new tactics of teaching science that can enhance the learning outcomes of students. Government schools frequently make use of conventional teaching tactics like lecture methods, rote learning, and book reading. It is a common observation that students have a meager interest in science as they consider it boring and difficult among other subjects. As a result, mostly they have poor results in this subject. The use of innovative digital pedagogy may allow students to become much more engaged in constructing their own knowledge and provide them with "learning by doing" experiences.

This study intends to do an intervention in the teaching-learning process to analyze what would be the effect on learning of students if a teacher uses Digital Pedagogy lessons with an e-curriculum. The electronic curriculum, or e-curriculum, contemplates computer-based learning. It relates to the availability of educational content digitally stored on portable storage devices such as CDs, DVDs, or USBs, its online accessibility, along with numerous other applications of informational technology like providing laptops/computers, multimedia projection systems, and internet-compatible classrooms.

This intervention is initially adopted for three episodes of a topic from the single-national curriculum of science. The selected topic is "Water." It is assumed in the present study that by using digital pedagogy and e-learn video content of science, it is possible to enhance the quality of the teaching-learning process as students are expected to take more interest in the video content of lectures. Baddeley's model of working memory supported that video content used in the classroom with verbal and visual feature facilitate learner to well understand and retain the subject taught for a longer period of time.

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Importance of Using Digital Pedagogy in Classroom

Technology has pushed the limits for students of today. Technology is no more expensive or limited only to the privileged few. It has now become far cheaper, accessible, and advanced (Edwards, 2009). Integration of ICT proves useful for both students and teachers. Existing research findings show that teaching practices with well-equipped preparation along with using IT Gadgets are the key factors of successful technology-based teaching-learning practices. (Ghavifekr, Rosdy, & Science, 2015).

In the recent era of technology, it is necessary to use new technologies in the classroom to provide probabilities to students for learning. Existing literature provides evidence that the education system still adopted outdated teaching pedagogies that are not appropriate to prepare the learner according to the need of society. Students are less creative and don't have practical skills and knowledge. In the scenario of the 21st, it's necessary to integrate new technologies and Gadgets in the classroom to prepare learners for the expected challenges of the global world (Yelland, 2003).

Digital Pedagogy and Students Learning

IT Gadgets play an important role in improving the quality of learning in the classroom as using these educational gadgets is productive for the teacher to improve their teaching practices and results of their students. Technology tools can meet the requirements of a diverse group of learners and make them able to improve their results. (Grismore, 2012). The use of digital technologies in the field of education has gone through a major shift over the past few decades. Televisions, computers, software, scanners, digital cameras, multimedia projectors, the internet, tablets, smartphones, and smartboards are a few elements of this technology (Fu, 2013; Cassidy, 1998; Kingston, 1992). Pedagogy should be adopted by teachers according to the need of time and students' requirements. Students may lose motivation and interest with the persistence of tutors in teaching obsolete subjects and skills which have gradually become inconsistent with the demands of the real world (Usher & Center on Education, 2012).

Most research studies are concerned about student attainment, and they follow various techniques to measure the performance of students. Standardized achievement test considers mostly for the evaluation of learner achievement. A research study by young describes under controlled situations that show that students with access to Technology Gadgets along with well-planned teaching learn fast with a clear understanding than students who don't use that tool. (Young, 2008). Bughio et al. (2014) showed optimistic relation of students' academic performance with the training to use ICT equipment. Similarly, Hassan & Sajid (2013) also found a positive students inclination towards ICT.

Punjab Government's initiative to digitize the School Education System.

To uplift the standard of provincial education and to digitize the schools and education system, the Punjab Government originated Punjab E-Learn Program in 2015. The web-based repository of E-Learn Punjab (http://elearn.punjab.gov.pk) consists of a digitized curriculum of Mathematics and science for classes one to intermediate. This program aimed at the encouragement of the use of technology gadgets in schools in order to improve the quality of the teaching-learning process in the province.

Presently, most of the government elementary schools are equipped with ICT devices like LED/LCD screens, which are used for Nursery Rhymes or celebrations of a National Day at Pre-School levels. Tablets are being used to teach a few subjects in primary schools; for example, in Class three, the subjects of Urdu, English, and Maths. Computer Labs are available in all high schools but are used just for the practical purposes of computer science students of classes 9th and 10. It is important to upgrade the use of available ICT Devices in a more productive and creative way that can enhance the students learning outcomes and improve the teaching skills and methodology.

In the case of Punjab, especially at the school level use of technological innovations are not very common; however, their acceptance and utilization have enhanced in the higher education sector in universities. There exists a research gap, especially in regards to technology utilization in pedagogy at the school level in order to improve the quality of the teaching-learning process. In the current scenario, it is very imperative to do a comprehensive qualitative analysis to trace out

the effects of digital pedagogy on students learning outcomes and attitudes.

As literature provides evidence that the use of digital tools in classroom instructional pedagogy improve students' performance, make it enjoyable to learn, benefit literacy, numeracy, creativity, and other learning capacities. It is a need of time to adopt similar pedagogy schemes in the context of digital tools and technologies for the education system of Punjab.

Discourse Analysis on IRF Pattern of Exchange

Tutorial room discourse illustrate how pupils are involved in the discourses with the distinctions of their responses in reply to instructor queries and feedback. (Lee 2018) IRF (Initiation, Response, and Feedback) model of Sinclair and Coulthard (1975) was used to analyze the classroom discourse. Each individual contribution to the exchange made within the classroom participants is a move or turn. The IRF pattern of moves creates a reciprocal teacher-student relationship in the classroom. The teacher initiates with a question, the student's response to the question posed, then the teacher gives an evaluative follow-up or feedback before raising another question. There are many different studies which evaluate classroom interactions through IRF. Hong (2009), Pinkevience (2011), and Cohen (2011) specifically have discussed IRF to build active interaction between teacher and students in a classroom. The said interaction, specifically in a classroom environment, occurs as long as the teacher and students are communicating with each other, giving actions in the form of questions or queries, and receiving response reactions in one way or the other, anywhere and anytime in the classroom setting. In the words of Musdalifah (2016), the term interaction can be described "as the heart of communication; it is what communication is all about. " (Brown, 2001)

The transcription of recorded video episodes was analyzed with the IRF model, using a mixed framework, influenced from Richard and Lockheart (1996), Brown (2001), and Hardman et. al. (2003). Each move/turn was subdivided into three categories as described below.

Classroom discussions on a topic/lesson start with the teacher's opening move. This move is termed as initiation, where the teacher begins with one of the three questions, i.e. Procedural, Convergent or Divergent. A Procedural question is used to engage students in discussions or facilitate them in understanding the topic. For the present study, the means and use of digital pedagogy shall fall into this category of initiation. The Convergent questions are usually simpler but direct to encourage student interactions, in relatively plain yes/no responses. The Divergent questions are also posed to encourage student interactions but in a comparative way of response, where the students can come up with different concepts on the topic based on their perceptions. Such a response reflects their individual way of thinking, giving a more relative appreciation of the topic in the classroom discourse.

The Response moves are all student-centered since they represent the reply from the students. Silence occurs whenever the classroom interaction is broken by non-responsiveness, or with gaps when there is no verbal communication from the student's side. On the contrary, the student reaction, opinion, or idea shared in response can also be unique and maybe one possible way to the answer. Such a response is termed as Open-ended or Student-initiated; these responses are usually instigated from divergent initiations. The third type of response is specific, yes/no, or the only natural reply to a usually "Convergent" initiation.

The final move has been subdivided into Conclusive, Evaluative, and Elaborative Follow-ups by the teacher. The Follow-up is Conclusive when the teacher sums it up at the end. It is Evaluative if the teacher attempts to rank or provide results of the student responses as the lecture outcome. However, when the teacher rephrases his/her own words or expands the interaction by providing more information, the Follow-up is termed as Elaborative.

The study is intended to explore the impact of digital pedagogy, looking for improved levels of collaboration, reasoning, and academic attainment as the desired outcomes for improving the quality of classroom interaction amongst teachers and students. The inherent primary methodology involves the use of digital technology through minimal resources for supporting classroom dialogue, such that it can influence the joint construction of knowledge in the classroom. Classroom discourse in my study is defined as all verbal & non-verbal interaction in the classroom between teacher and learner and

learner with the teacher and other class fellows. Active classroom discourse empowers students to express their thinking, ideas, and reasoning that would be a central element of acquiring knowledge.

Its students centered class as teacher focus is to improve teaching-learning quality in science class and to improve the student's interest in science and concrete understanding of the subject. The teacher mostly take procedural initiation so to check and relate the student's previous knowledge to the current topic. The teacher tries to involve all students in class. Walsh (2006) and Dagarin (2004) advocate that if logical input is provided to the students through interaction with the teacher, they are able to improve their existing knowledge and understanding by creating, linking, and constructing their mental plans.

Its due to the advantages of digital devices as a teacher have fully control of volume, pause, and reply the video content that seems very helpful for students to remember and understand the content, and this understanding and retention of knowledge is clearly visible in their response in teachers questioning after each video section. Baddeley's model of working memory supported that video content used in the classroom with verbal and visual feature facilitate learner to well understand and retain the subject taught for a long period of time.

Teachers try to involve students by asking more divergent questions so as to take view of multiple ideas by different students and engage them actively to think and relate ideas for knowledge construction. With the use of digital pedagogy, students' interest in science is increasing day by day as their silent reply changes to the specific and open-ended response. They start replaying to teacher and taking part in classroom discussion. In their response use of scientific terms and accurate replies show retention on scientific knowledge and its reproduction. Students wait for science class, and their attendance in class shows their interest and change attitude towards science. Teacher focus on elaborative and conclusive follow-up as that encourage students that their ideas are accepted and appreciated by the teacher. Evaluative follow-up may create a sense of fear or hesitation in students to take an active part in classroom interaction.

Methodology

This research study is intended to investigate the viability of digital pedagogy lessons at the elementary level. A qualitative case-study approach has been adopted to explore the effects on students learning and their attitude towards science. The 7th class of a public elementary school from District Kasur was selected. The topic of "Water" from the single-national curriculum of science was taught with an intervention. Data was collected through recorded video observations, and classroom discourse was analyzed to explore the productive potential of digital pedagogy lessons for the elementary level Science class.

Findings and Discussion

The classroom interaction for covering the topic of "Water" in three episodes was transcribed and subjected to the IRF pattern. The classroom discourse analysis indicated that 51% of initiation turns were required by the teacher, the student responses were around 40%, whereas the remaining 9% were students' grouped responses, as shown in the pie chart below. Further detailed enumeration of the IRF individual categories is provided in the following table.

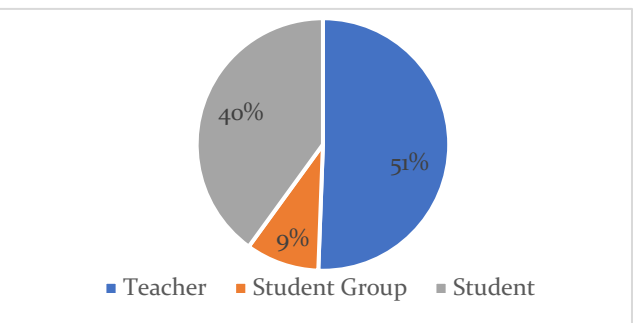


Figure 1: Total Turns Percentage for the Overall Classroom Interaction

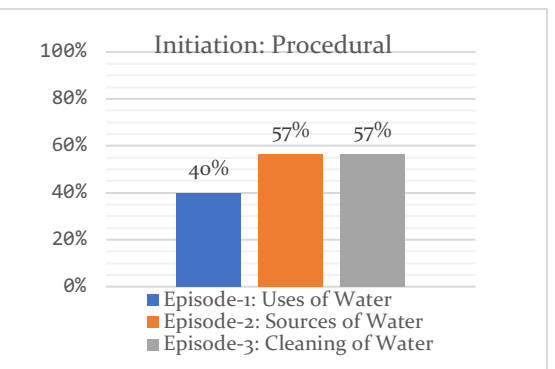
Table 1. Categories of IRF Moves

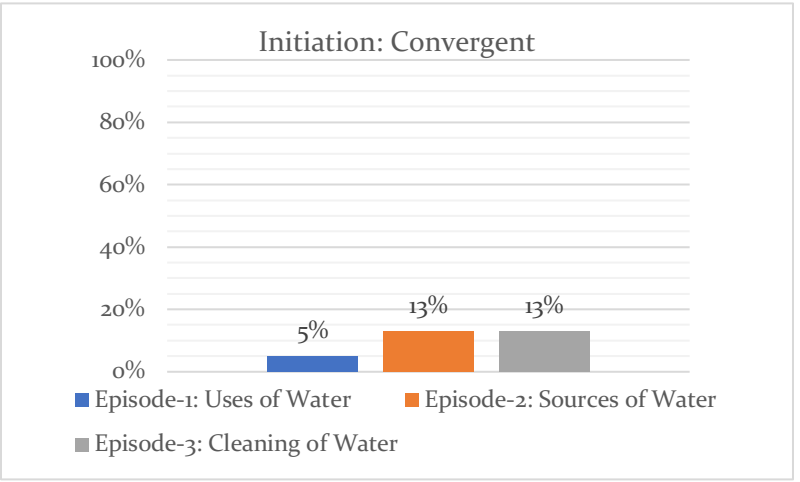
IRF MOVE	Total
Initiation	73
Procedural	33
Convergent	7
Divergent	32
Response	84
Silence	5
Open-ended or Student Initiated	28
Specific	44
Follow-up	70
Conclusive	2
Elaborative	29
Evaluative	32

As three types of initiation moves are focused in this study and the finding of the discourse analysis of three episodes from a public sector elementary science classroom reveals that procedural initiation is mostly the focus of teacher initiation so to check and relate the student's previous knowledge to the current topic to check the readiness of students for new learning as data revealed that in episode 1, 2 and 3 the procedural initiation was respectively 41%, 57 % and 57 % of the total initiation move. As a Teacher wants to have maximum students' responses in classroom interaction, so she prefers divergent type questions to contrast and relate various ideas by learners regarding the topic and so as to enhance learning and understanding of students about difficult content science. As data revealed that in episodes 1, 2, and 3, the divergent initiation was respectively 55%, 30 %, and 30 % whereas the convergent type initiation was reported as 5%, 13 %, and 13 %, respectively.

As three types of response moves are focused in this study and the finding of the discourse analysis of three episodes from a public sector elementary science classroom reveals that in general and easy topic students were very energetic and active to respond teachers questioning as no silence response is reported in episode 1 and in episode 2 and 3 there were 8 % turns that show silence/ paused response by pupils. Student-initiated or open-ended reply was reported 62 % in the episode and 4 % in episode second and third. Students' Specific response was reported higher in episode second and third as compared to episode one that was due to the topic of that lessons. With the use of digital pedagogy students' interest in science is increasing day by day as their silence reply changes to specific and open-ended response. They start replaying to teacher and taking an active part in classroom discussions.

Teachers follow up response type play an important role to make a productive and students centered class room environment. As if teacher do more evaluative feedback that cause fear and consciousness in students to respond. They hesitate in responding. Rather than that if teacher focus on elaborative and conclusive follow up that will encourage students that their ideas are accepted and appreciated by the teacher. Evaluative follow up may create a sense of fear or hesitation in students to take an active part in classroom interaction.





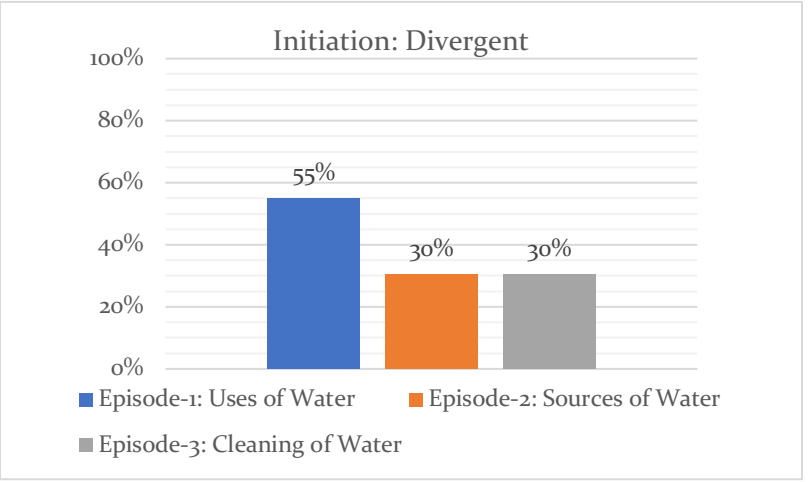
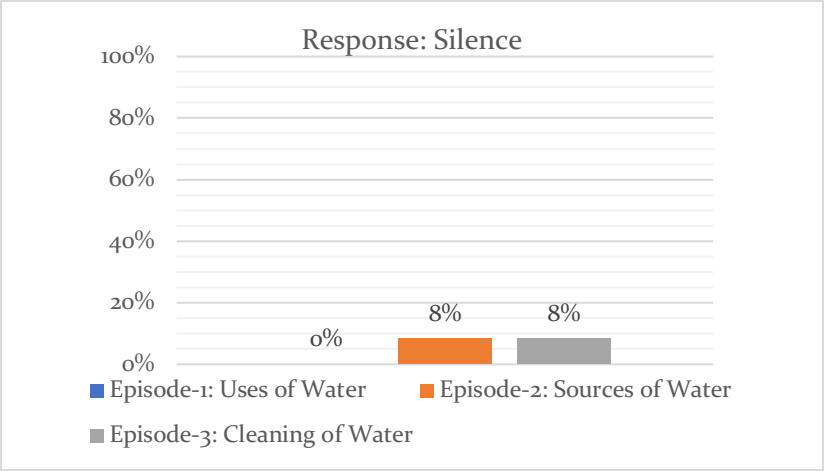


Figure 2: Categorized Percentages of Initiation Turns for the Overall Classroom Interaction



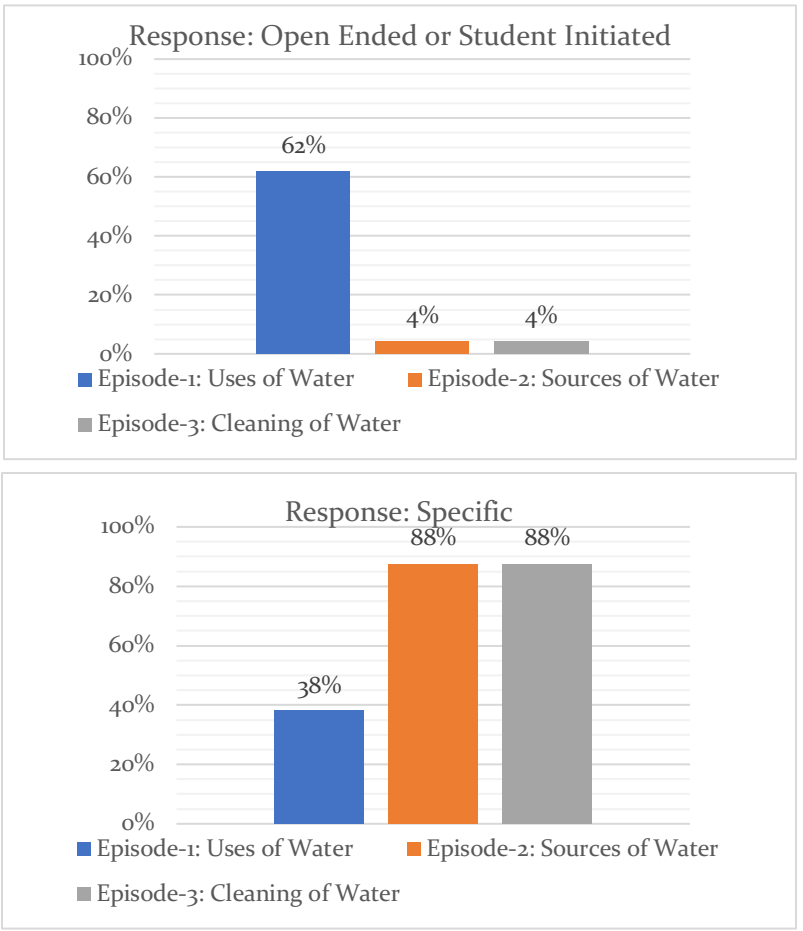
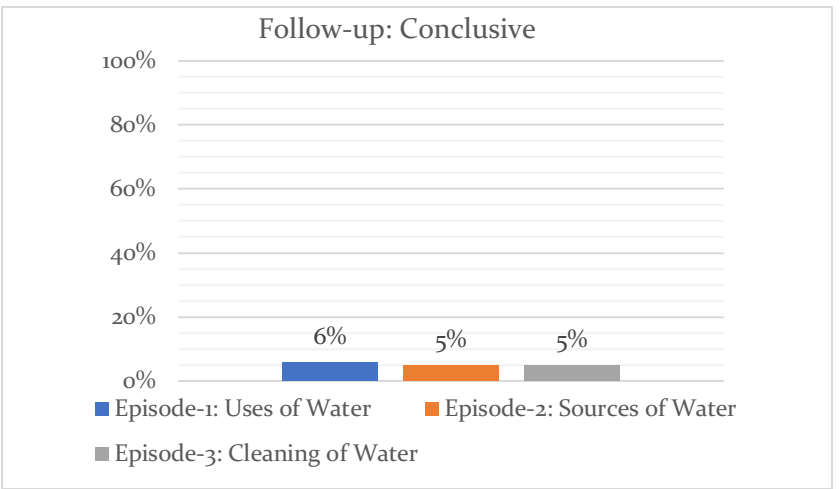


Figure 3: Categorized Percentages of Response Turns for the Overall Classroom Interaction



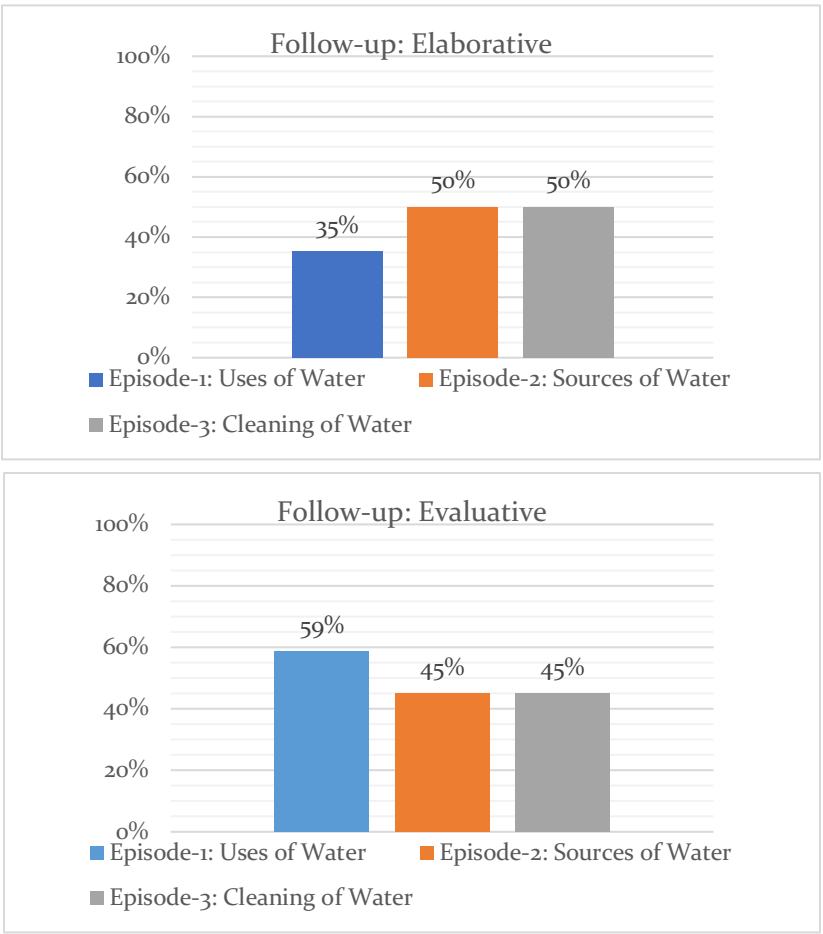


Figure 4: Categorized Percentages of Follow-up Turns for the Overall Classroom Interaction

Findings show that there was conclusive type of follow up about 6 %, 5 % and 5 % respectively in episode one to three. Elaborative follow up was reported 35 % in episode one and 50 % in episode second and third. Evaluative follow up was explored 59 % in episode one and 45 % in episode second and third.

Conclusion and Recommendations

Based on the findings its concluded that interaction pattern in classroom usually initiated by instructor with warm up queries, introducing current topic, showing some relevant video clips, Reading of E-textbook from Screen, asking the questions and pointing out which student have the turn to reply. Students' responses relate to topic, content as well as the way of teacher questioning and environment prevails in classroom.

Teachers follow up response type play an important role to make a productive and students centered class room environment. Follow up is substantial to surge students' self-confidence, inspiration and assessment. As if teacher do more evaluative feedback that cause fear and consciousness in students to respond. They hesitate in responding. Rather than that if teacher focus on elaborative and conclusive follow up that will encourage students that their ideas are accepted and appreciated by the teacher. Evaluative follow up may create a sense of fear or hesitation in pupils to have energetic participation in classroom talk.

The research results recommend to practice digital pedagogy in the classroom for fruitful learning specifically to enhance the quality of

schooling with scarce resources in developing countries that are facing critique for providing the low quality of education. The suggestion for subsequent researchers to use some other patterns along with IRF to analyze classroom interactions. Furthermore, its suggested to initiate the interaction by students too and communication between instructor with group of students and whole class.

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