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Investigating the Transfer of Argumentation Skills through Engagement in an Online Learning Platform

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Abstract

The learning and instruction process in Pakistan is geared around teacher-centered activities. This research aimed at involving high school students in an interactive online learning experience and to explore the acquiring of scientific argumentation skills through this online engagement. The secondary objective of the study was to investigate the transfer of argumentation skills learned through online learning to its application in other subjects. The sample consists of students of grade X who were engaged in constructing argument in Physics topics for one month using a web blog. The argumentation reports were collected for four weeks and then analyzed for quality and progression. The researchers found that students learnt the argumentation skills using the web blog and were able to transfer the skill in the subject of Pakistan Studies. The result of this study provides the prospect for using online learning in schools and the significance of scientific argumentation in improving the learning process.

Keywords: Argumentation; online learning, web blog, transfer of skill

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Introduction

During the last few decades, many researchers advocate the developing of argumentation skills in students as one of the major aims of science education(Duschl & Osborne, 2002; Kuhn, 2010 & Osborne, 2010). Scientific argumentation is helpful in teaching socio-scientific issues(Chang & Chiu, 2008; Evagorou, Sadler, & Tal, 2011; Martín-Gámez & Erduran, 2018) and advancing scientific literacy (Dawson & Venville, 2009; Kutluca & Aydın, 2017).This method is useful in developing critical skills (Foong & Daniel, 2013)and improving conceptual understanding in students(Driver, Newton, & Osborne, 2000; Kaya, 2017).

Scientific argumentation is the process of making a decision which is supported through valid justification and evidence (Putri & Rusdiana, 2017). The process involves construction of knowledge(Ford, 2008). A good argument consists of a decision/claim, valid justifications for the claim and a rebuttal. The Toulmin Argument Pattern (Toulmin, 1958) mention six components in a quality argument. They are data, claim, warrant, backing, qualifiers, and rebuttal. Data is the fact or observation used to prove the argument. Claim is the decision being argued. Warrant provides some principle/rule to connect data and claim. Backing provides support to the warrant. Qualifiers suggest conditions for the argument to be true. Rebuttal provides counterargument to nullify the presented claim. The example presented by Toulmin is the issue of whether Harry is a British subject. The claim may be that Harry is a British subject. The data is that Harry was born in Bermuda. The warrant is that people born in Bermuda are British subject. The backing is the legal provision and law that person born in Bermuda is a British subject. The qualifier is that most probably, Harry is a British subject. The rebuttal is unless both of his parents were aliens; Harry will be a British subject.

With the advancement in science and technology, there is a considerable increase in the use of blogs/web blogs in educational settings (Kathpalia & See, 2016).Needless to say, research in argumentation is going in all fields of learning and instruction and the notion of ‘argue to learn’ and ‘learning to argue’ is tested and practiced widely in the educational institutes in developed countries. Though, there are also teachers in many countries that are forced to cram because this results in better grades in the examinations. Kathpalia and See (2016)

advocated that it is essential for students to learn argumentation skills. Rather, it should be one of the objectives of science education to develop the skills of scientific argumentation in students (Osborne, Erduran, & Simon, 2004). Unfortunately, there are certain limitations in applying argumentation in classroom teaching (Driver et al., 2000). These include the need for explicit instructions and provision of appropriate learning opportunities for students (Kuhn, 1991). Unfortunately, the educational institutions in developing countries are seriously lacking in the provision of learning materials and modern instructional methods (Faize, 2015). Though, there are pioneer works written in the late half of twentieth century that developed useful materials and exercises for developing the skills of argumentation and its application in science (Johnstone, Percival & Reid, 1981; Reid, 1980). Unfortunately, these researches were not properly utilized except its replication in research literature. Taking the case of Pakistan, the teaching resources are scarce, the classrooms have large strengths of students, the curriculum is heavily laden with content, and the teachers are de-motivated (Faize, 2011). There is a strong need to overhaul the education system from teacher centered to student-centered in Pakistan. Some researches on scientific argumentation have been conducted in Pakistan for example, introducing scientific argumentation in teaching ethic based topics (Faize, 2015), involving elementary students in scientific argumentation (Hussain, Faize, & ur Rahman, 2017) and developing argumentation skills in undergraduate students (Faize & Dahar, 2017). These studies have found the effectiveness of scientific argumentation in improving academic performance and students' interest in learning. There is ample research on the use of online learning environment to support scientific argumentation e.g., Foong and Daniel (2013); Kathpalia and See (2016);Yeh and She (2010) etc. However, no research is conducted to explore the use of argumentation in online learning in Pakistan. This research is aimed at investigating the use of weblog as an online learning platform for practicing scientific argumentation with science students of grade X. The quality and progression in argumentation skills will also be explored during the interaction phase. Furthermore, the study would explore the transfer of argumentation skill from online learning to its application in the subject of Pakistan Studies.

Methodology

Population and Sample

The population for the present study was all science students of secondary level in Islamabad. The sample for the study was taken from a private school in Islamabad. The sample consisted of 47 science students of grade X studying Chemistry, Physics and Computer Science. The private school was purposively selected to meet the criteria of availability of proper computer lab in online learning because, involving students in scientific argumentation requires instructional material and support (Macpherson, 2016).

Challenges

The first challenge that the researchers faced was the involvement of school students who have little experience of modern teaching methods especially the use of online web tools. The researcher constructed a blog page to provide an online platform for engaging students in constructing their argument. Figure 1 shows the constructed web blog with the argumentation report written by one of the groups. The reason for using blogs was its utility in improving students' understanding (Brownstein & Klein, 2006), developing communication skills (Ducate & Lomicka, 2005) and encouraging extended discussion (Maag, 2005). The webpage also contained buttons for reminding the students about the necessary components of argumentation so that they don't miss any component. The reminder buttons were available for first two weeks and were then removed to see if the students can still follow the argumentation structure. The students were also allowed to respond on the argumentation report of other groups and to counter the argument of other groups.

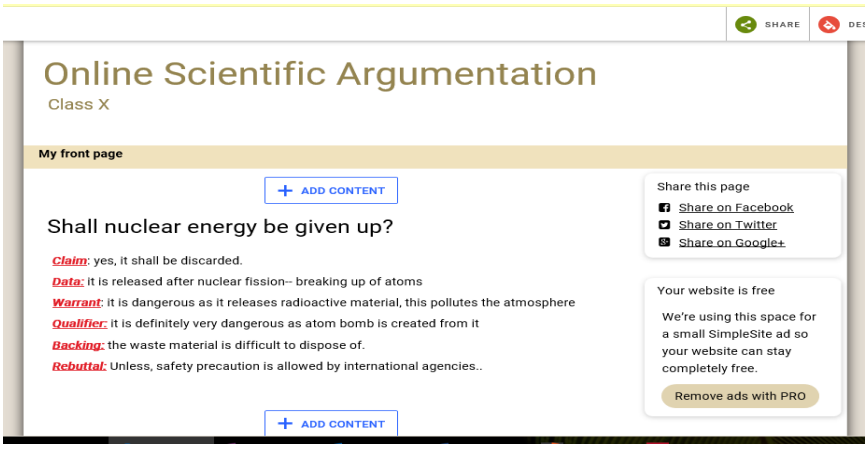

Figure 1: The online web blog constructed for argumentation practice

Procedure

The first phase of the research was to brief the subject teachers and sample students about scientific argumentation and its structure. The researchers conducted two briefing sessions of 45 minutes each with the two teachers, and the students on how to construct an argument. Relevant examples were given to clarify the concept of argumentation. We also ensure that one of the researchers is at least present during the class to ensure the students are properly involved in the online argumentation. The class had five periods of Physics subject in a week. The duration of each period was 45 minutes. We requested the school administration to allow one period in each week for online construction of argument which was granted. This activity continued for four weeks.

In the second phase, we formed group of students. The school computer lab had 19 computers that were made functional to connect to the internet. We divided the 47 students into groups of two and three to ensure all the groups can work on a computer. A total of 19 groups were formed for using online platform.

In the third phase, the students were engaged in writing their argumentation report on the web blog for the selected topic in Physics. Each group was allotted a unique user nameon the blogsto conceal group identity during critiquing the othergroups. Otherwise, students feel reluctance to challenge the views of their fellow students(Coffin, Hewings, & North, 2012). All the groups could see the argument and rebuttal of each other and could further respond to counter argument of others. Each group was expected to rebut at least one group to complete

the structure of argumentation. The topics for argumentations were: the issue of energy generation, global warming and green-house effect, energy crises, and renewable and non-renewable energy sources. The teacher would announce the topic for argumentation a week before to ensure the students prepare the topic.

Research Instrument

The online argumentation report of each group saved on the blog was used to analyze the quality and progression in the argumentation skill. For each week, 19 online argumentation reports were collected from the weblog. The total numbers of argumentation reports collected at the end of the month were 76.

The second instrument was students' written argumentation report on loose sheets for exploring the transfer of argumentation skill in Pakistan Studies. In order to ensure objectivity in the marking, we use the analytical framework given by Osborne, Erduran, & Simon(2004) as given in table 1. Both the researchers' cross-check the marked reports to ensure that the reports are marked correctly.

Investigating the Transfer

In order to investigate the transfer of argumentation skills from Physics to Pakistan Studies, the researchers discontinued the online activity for three weeks. The gap was intentional to observe whether the students retain the skill learnt in the online argumentation and can transfer it in other subjects. The subject of Pakistan Studies was chosen to investigate the transfer of argumentation skills from science concepts to non-science content. Perhaps, this would also help in generalizing transfer of argumentation skills in real life context/situation.

Analysis of Data

The written argumentation blogs were analyzed through analytical framework given by Osborne, Erduran, & Simon in 2004. The scoring scheme for argumentation report was based on the level of argument given in table 1.The following example is taken from a student's argumentation report in Pakistan Studies to assess the quality of argument. The topic under discussion was: Is two party political systems better for democracy in Pakistan?

[Claim]: No
[Data]: Both the major parties did not bring any good improvement in Pakistan so far.
[Warrant]: The two-party system does not offer any choice for people.
[Rebuttal]: Had both the parties ruled with responsibility, then the two-party system may be allowed.

The above argumentation report includes a claim, data, warrant and a weak rebuttal. This kind of argument will come under level 3 and is given 3 score for quality as criteria mentioned in table 1. Similarly, the argument presented in figure 1 consisted of all the components of argument and will be included in level 4.

Table 1

Level of Argumentation and score assigned to each level

Argumentation Structure	Level	Score
simple claim	1	1
Claim with data, warrants, or backings, but no rebuttals.	2	2
Series of claims with data, warrants, or backings and a weak rebuttal.	3	3
Claim with a clearly identifiable rebuttal.	4	4
Extended argument with more than one rebuttal.	5	5

We analyzed 76 argumentation reports collected during the four weeks. The reports were further divided into first bi-weekly reports and the last bi-weekly report to compare the quality of argumentation when the assistance buttons were removed from the web blog. The quality of argumentation report was also compared week wise to see the progression in argumentation skill using ANOVA.

Results and Discussion

The data in table 2 shows the mean score during the first and last two weeks with standard deviation.

Table 2

Students score during the first and last two weeks

	Mean	N	SD	t	r
First bi-weekly	3.2	19	0.8		
				4.7	.4
Second bi-weekly	3.9	19	0.5		

The score of students during the first bi-weekly and second bi-weekly argumentation report were weakly correlated which was not significant (r = .4, p = .09). The mean score during the last two weeks (3.9) was greater than the mean score during the first two weeks (3.2). Comparing these means, a significant difference was observed using t test (t_{18} = 4.7, p< 0.001). This indicated students' improvement in the quality of argumentation skill in the last two weeks despite that the reminder buttons were removed from the web page. This indicates that the students retained the information about argumentation components and included them in their reports.

Table 3

Students' score on argumentation reports week wise

Argument Level	Mean	SD	N	F	p
Week 1	2.6	1.2	19		
Week 2	3.7	1.1	19	9.6	<.001
Week 3	3.9	.8	19		
Week 4	4.0	.6	19		

Repeated measure ANOVA was used to find if the argumentation quality significantly differed for the four weeks. For using ANOVA, sphericity assumption must be met which was found through Mauchly's test of sphericity. The test gave p=.2 thus, sphericity assumption was met. The result from ANOVA indicated that the quality of students' argumentation reports significantly improved during the four weeks, F (3, 54) = 9.6, p<.001.One reason for this improvement may be the effect of involvement in online interaction (Clark, D'Angelo, & Menekse, 2009).The students post their argument and can also see the counterargument of other students on their screen; which gives them the opportunity to refine and improve their argument (Kirschner, Buckingham-Shum & Carr, 2012).

The transfer of argumentation skills was observed in Pakistan Studies after a lapse of three weeks. This time, each student was expected to write the argumentation report on a piece of paper. The purpose was to observe the individual effect rather than the groups for transfer of argumentation skill. Out of 47 students, 43 students were present during the activity. The topic for writing argumentation report was 'Shall Pakistan goes for early elections in 2018'. The data in table 4 shows that many students were able to write argumentation report with level 3, 4 and 5 and there were less number of students in writing level 1

and 2. The mean score of the class was 3.5 representing a good value. Thus, it can be concluded that argumentation skill can be learnt and applied by students in other subjects as well. This is also supported by (Foong & Daniel, 2013; Yang & Tsai, 2010).Nussbaum (2002) also found that students in social studies improved in argumentation skills after scaffolding which in this study was provided through online weblog.

Table 4

Number of students and their level of argument

Level	Number of students	mean	Std. Dev.
1	0		
2	5		
3	18	3.5	0.9
4	12		
5	08		

The findings also revealed that rebuttal was the difficult part in writing argument. Only eight students out of 43 were able to include correct rebuttal in their report. The difficulty in writing rebuttal was also found in other studies such as (Faize, 2015; Foong & Daniel, 2013; Hussain et al., 2017; Topcu, Sadler, & Yilmaz-Tuzun, 2010). Moreover, some students face difficulty in writing argumentation report despite support from the instructor. One reason for this difficulty may be the lack of students' prior experience in participating in discussion and/or activity based learning. Newton, Driver, and Osborne (1999)mentioned similar reason for difficulty in argumentation.

Conclusion

This research was aimed at involving secondary grade students in an online experience for constructing scientific argumentation in Physics. Utilizing online learning in Pakistani context has a great bearing in using the technology for improving academic performance and conceptual understanding.The study also tried to explore whether the school studentscan transfer the argumentation skills in other subjects. The findings revealed that the students learned the argumentation skills through an online platform and this skill improved with time. Further, it was observed that the students were able to transfer the argumentation skill from Physics to Pakistan Studies subject. However, this study could

not find whether the transfer of argumentation skill was due to practice with online platform or effectiveness of scientific argumentation itself. This area can be further research upon. Moreover, future studies may explore the transfer of argumentation skills in real life situation and/or the use of online learning experience in improving the academic performance and attitude towards learning.The sample for the present study is taken from a private school and thus care must be exercised its generalization to the entire population. Rather, the conclusions are applicable only to the selected sample. Future studies may apply the concept taking into consideration the public schools as well.

Reference

Brownstein, E., & Klein, R. (2006). Blogs: Applications in science education. *Journal of College Science Teaching*, *35*(6), 18.

Chang, S., & Chiu, M. (2008). Lakatos' scientific research programmes as a framework for analysing informal argumentation about socio scientific issues. *International Journal of Science Education*, *30*(13), 1753-1773.

Clark, D. B., D'Angelo, C. M., & Menekse, M. (2009). Initial Structuring of Online Discussions to Improve Learning and Argumentation: Incorporating Students' Own Explanations as Seed Comments Versus an Augmented-Preset Approach to Seeding Discussions. *Journal of Science Education and Technology*, *18*(4), 321-333. Retrieved from http://doi.org/10.1007/s10956-009-9159-1

Coffin, C., Hewings, A., & North, S. (2012). Arguing as an academic purpose: The role of asynchronous conferencing in supporting argumentative dialogue in school and university. *Journal of English for Academic Purposes*, *11*(1), 38-51.

Dawson, V., & Venville, G. J. (2009). High school Students' Informal Reasoning and Argumentation about Biotechnology: An indicator of scientific literacy? *International Journal of Science Education*, *31*(11), 1421-1445.

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, *84*(3), 287-312.

Ducate, L. C., & Lomicka, L. L. (2005). Exploring the blogosphere: Use of web logs in the foreign language classroom. *Foreign Language Annals*, *38*(3), 410-421.

Duschl, R. A., & Osborne, J. (2002). Supporting and promoting argumentation discourse in science education. *Studies in Science Education*, *38*, 39-72.

Evagorou, M., Sadler, T., & Tal, T. (2011). Metalogue: Assessment,

Audience, and Authenticity for Teaching SSI and Argumentation. In Bernadette Ohmer (Ed.), *Socioscientific issues in the classroom* (pp. 161–166). doi: 10.1007/978-94-007-1159-4-9

Faize, F. A. (2011). *Problem and prospect of science education at secondary level in Pakistan (Unpublished doctoral dissertation)*. International Islamic University Islamabad, Pakistan.

Faize, F. A. (2015). Introducing Argumentation at Higher Education in Pakistan Paradigm of Teaching Ethic based Topics. *FWU Journal of Social Sciences*, *9*(1), 8-13.

Faize, F. A., & Dahar, M. A. (2017). Developing Argumentation Skills among Undergraduate Students Using Inquiry Led Argument Framework. *Pakistan Journal of Education*, *34*(2), 37-54.

Foong, C., & Daniel, E. (2013). Students' argumentation skills across two socio-scientific issues in a Confucian classroom: Is transfer possible? *International Journal of Science Education*, *35*(14), 2331-2355.

Ford, M. (2008). Disciplinary authority and accountability in scientific practice and learning. *Science Education*, *92*(3), 404-423.

Hussain, M. A., Faizi, F. A., & ur Rahman, F. (2017). Engaging Elementary School Students in Scientific Argumentation: Effectiveness and Limitations. *Journal of Elementary Education*, *27*(1), 71-82.

Johnstone, A. H., Percival, F., & Reid, N. (1981). Is knowledge enough? *Studies in Higher Education*, *6*(1), 77-84.

Kathpalia, S. S., & See, E. K. (2016). Improving argumentation through student blogs. *System*, *58*, 25-36. Retrieved from http://doi.org/10.1016/j.system.2016.03.002

Kaya, E. (2017). Argumentation in elementary science education: addressing methodological issues and conceptual understanding. *Cultural Studies of Science Education*, 1–4.

Kirschner, P. A., Buckingham-Shum, S. J., & Carr, C. S. (2012).

Visualizing argumentation: Software tools for collaborative and educational sense-making. London: Springer Science & Business Media.

Kuhn, D. (1991). *The skills of argument*. New York: Cambridge University Press.

Kuhn, D. (2010). Teaching and learning science as argument. *Science Education*, *94*(5), 810-824.

Kutluca, A. Y., & Aydın, A. (2017). Changes in Pre-service Science Teachers' Understandings After Being Involved in Explicit Nature of Science and Socioscientific Argumentation Processes. *Science & Education*, *26*(6), 637-668.

Maag, M. (2005). The potential use of "blogs" in nursing education. *CIN: Computers, Informatics, Nursing*, *23*(1), 16-24.

Macpherson, A. C. (2016). A Comparison of Scientists' Arguments and School Argumentation Tasks. *Science Education*, *100*(6), 1062-1091. Retrieved from http://doi.org/10.1002/sce.21246

Martín-Gámez, C., & Erduran, S. (2018). Understanding argumentation about socio-scientific issues on energy: a quantitative study with primary pre-service teachers in Spain. *Research in Science & Technological Education*, *36*(4) 1-21.

Newton, P., Driver, R., & Osborne, J. (1999). The place of argumentation in the pedagogy of school science. *International Journal of Science Education*, *21*(5), 553-576.

Nussbaum, E. M. (2002). Scaffolding argumentation in the social studies classroom. *The Social Studies*, *93*(2), 79-83.

Osborne, J. (2010). Arguing to Learn in Science: The Role of Collaborative, Critical Discourse. *Science*, *328*(5977), 463–466. Retrieved from http://doi.org/10.1126/science.1183944

Osborne, J., Erduran, S., & Simon, S. (2004a). Enhancing the quality of argumentation in school science. *Journal of Research in Science Teaching*, *41*(10), 994-1020. Retrieved from http://doi.org/10.1002/tea.20035

Osborne, J., Erduran, S., & Simon, S. (2004b). Enhancing the quality of argumentation in school science. *Journal of Research in Science Teaching*, *41*(10), 994-1020. Retrieved from http://doi.org/10.1002/tea.20035

Putri, M. D., & Rusdiana, D. (2017). Identifying students'scientific argumentation skill at junior high school 1 argamakmur, North Bengkulu. *International E-Journal of Advances in Education*, *3*(9), 566-572.

Reid, N. (1980). Simulation techniques in secondary education: Affective outcomes. *Simulation & Games*, *11*(1), 107-120.

Topcu, M., Sadler, T., & Yilmaz-Tuzun, O. (2010). Pre-service science teachers' informal reasoning about socio-scientific issues: The influence of issue context. *International Journal of Science Education*, *32*(18), 2475-2495.

Toulmin, S. (1958). *The uses of argument.* Cambridge, England: Cambridge University Press.

Yang, F.-Y., & Tsai, C.-C. (2010). Reasoning about science-related uncertain issues and epistemological perspectives among children. *Instructional Science*, *38*(4), 325-354.

Yeh, K. H., & She, H. C. (2010). On-line synchronous scientific argumentation learning: Nurturing students' argumentation ability and conceptual change in science context. *Computers and Education*, *55*(2), 586–602. http://doi.org/10.1016/j.compedu.2010.02.020

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