USEJ 9 (2) (2020)

Unnes Science Education Journal

http://journal.unnes.ac.id/sju/index.php/usej

PRIMARY SCHOOL TEACHER'S UNDERSTANDING AND SELF-EFFICACY TOWARDS IMPLEMENTATION OF INQUIRY-BASED INSTRUCTION IN PRIMARY SCIENCE CURRICULUM: CASE OF KIGALI CITY-RWANDA

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Article Info

Article History:
Received March 2020
Accepted June 2020
Published July 2020

Keywords:Inquiry Based instruction, Teachers'understanding, Teachers'self-efficacy

Abstract

This study explored public primary school teachers' understanding of inquiry based instruction, teachers' self-efficacy for inquiry based instruction and its actual implementation in upper primary science classroom. Data included servey instrument usingeveryday teaching sennarios to measure teachers'understanding, self-report servey instrument to measure teachers' self-efficacy for inquiry based instruction, individuals' interviews and classroom observation through Electronic Quality of Inquiry Protocol (EQUIP) designed to measure the quality and quantity of inquiry being implemented in science classroom. The results of this study revealed that teachers' undesrtanding has limited description of the components of inquiry based instruction to only posing and answering the questions in science classroom. They failed to decribe all components of inquiry based instruction as listed in competence based curriculum as the vehicle of the entire learning and teaching process which lead to insufficient understanding of inquiry based instruction. Their self-efficacy for inquiry based instruction is high and their actual implementation is at lowest level, none of the components of inquiry science classroom has implemented by participating teachers. No factors predicting implementation found among teachers 'understanding of IBI, teachers' self-efficacy for IBI and their demographic information. Implications for teacher-education and research about self-efficacy and teachers' understanding are discussed.

p-ISSN 2252-6617
e-ISSN 2252-6232

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INTRODUCTION

Educational reform in science is aiming to solve almost all problems observed in society and to form a better future for all citizens. The National Science Education Standards (NSES) is a current reform document aimed at improving scientific literacy for all (National Research Council, 2000). The standards emphasized an approach to teaching and learning about science for achieving that challenging goal, emphasize scientific inquiry, as a critical feature. The National Research Council (1996) described the scientific inquiry as to the numerous methods scientists study and explains the natural world, searching for conclusions using proof from their work. To distinguish inquiry-based instruction from inquiry in a general sense and the one practiced by scientists, the Standards highlights five essential features of science classroom inquiry:

- Learner engages in scientific questions;
- Learner prioritizes to find evidences in responding to questions;
- Learner formulates explanations from evidence;
- Learner connects explanations to scientific knowledge; and
- Learner communicates and justifies explanations (NRC, 2000, p.24).

Every classroom activity that struggles to use all five features, as detailed above, is reflecting inquiry-based science instruction (Ansberry & Morgan, 2007). Inquiry-based instruction in science fosters students 'scientific literacy and a better understanding of the concepts (Haury, 1993). In 2000, Owens & Reed asserted that it involves teaching students science process skills, critical thinking skills and scientific reasoning skills. Also, Doig & Groves (2011) described it as a strategy that aims to develop students 'skills used to deal with problems that may encounter in everyday life. As a result, students should be encouraged to ask scientific questions rather than answer them. Inquiry-based instruction is a crucial focus for twenty-first-century science teaching especially in many science curricula developed recently (Marshall et al., 2016). The role of those new science curriculum is to facilitate students in exploring concepts instead of memorizing facts, making them more active thinkers. The role of the teacher in the classroom will remain critical; they will act as facilitators, guider and helpers instead of giving all information to the students. Teachers should be capable of using various instructional strategies to allow students to understand scientific concepts through investigations, where students should be able to plan and conduct scientific investigations and construct their knowledge and better understanding through scientific inquiry. Nevertheless, many researchers claimed that inquiry-based instruction is not implementing in many science classrooms (Capps & Crawford, 2013). Many factors have associated with the failure of in-service sciences teachers to perform inquiry-based instruction in the science classroom; some of these reasons include a lack of competency, lack of a strong knowledge of science and the inability to use experimental skills and insufficient school resources. Colburn (2000) reported that lack of understanding and knowledge of inquiry-based instruction been a reason for a teacher not applying it. Understanding of inquiry-based instruction is the first step for implementing it, followed by how confident teachers are for applying that knowledge (Chichekian & Shore, 2014; Morrison, 2013).Those two personal factors may determine whether teachers feel strong enough to overcome any other barriers they may face in teaching inquiry science (Morrison, 2013; Smolleck et al., 2006; Lotter et al., 2018). Little is known about teachers ‘self-efficacy in general and classroom practices (Classen & Chiu, 2010) but rarely with specific regard to inquiry-based instruction in the science classroom.

Previous literature did not report how self- efficacy of newly adopters influences the actual implementation of inquiry-based instruction. No empirical evidence for exploration of how teachers ’understanding and their self-efficacy for inquiry-based instruction can influence its implementation in the science classroom. Teachers’ understanding of inquiry is necessary but insufficient to conceptually inquiry within science. Teachers need to connect inquiry and science concepts for better growth of their students’ competence (Syer, Chichekian, Shore & Aulls, 2012). On the other hand, teachers' self-efficacy for inquiry can affect its implementation but insufficient means to practice (Chichekian et al., 2016).

Some teachers conceptualize inquiry in some components than others; this conception will affect its implementation in the classroom. It meant that the way inquiry is understood can affect its enactment (Kang, 2008). Similarly, many scholars have reported that teachers' understanding is the main factor that shows their acceptance of implementation of inquiry and also incorporating the quality and the quantity of inquiry-based instruction in classrooms (Breslyn & McGinnis, 2012; Crawford, 2007; Kang et al., 2008; Lotter et al., 2007). The understanding of inquiry is only a beginning step, but insufficient. Teachers also need to feel confident in using inquiry in their classrooms. Feeling confident is important but also insufficient for practice in the classroom, the two variables; teachers with sufficient understanding and self-efficacy of inquiry-based instruction are interrelated, at some extent they may predict as to how teachers can struggle to overcome other barriers may face while implementing inquiry science teaching (Morrison, 2013). For many teachers in Rwanda, inquiry-based instruction, is "new knowledge", it has been stupilated in new competence based curriculum introduced in 2015 (Rwanda Ministry of Education, 2015). Little is known about the preparedness of the introduction of the competence-based curriculum (JICA, 2015). The series of questions should follow" are primary school teachers familiar with inquiry-based instruction? Do they know this approach? Knowledge of inquiry-based instruction however, not guarantees that teachers will be able to teach this topic effectively. Whybrow and Palmer (2006) pointed out that teachers' behavior in the classroom will highly influenced by their "own belief of their ability to teach, as well as a perception that their teaching strategies would be effective." This belief is what Bandura in 1986 has called teachers 'self-efficacy. Exploring teachers' self-efficacy for inquiry and teachers 'understanding of inquiry-based instruction may indicate different motivation and using levels regarding the quantity and quality of inquiry-based instruction in the science classroom (Marshall et, 2016). Most of the studies related to inquiry-based instruction and teachers 'self- efficacy done in developed countries where the contexts are different from developing countries like Rwanda. Exploring the relationship between two variables stated above will be the greatest contribution to the knowledge gap in inquiry-based instruction literature. So far, the experiences of the Sub-Saharan african countries like Rwanda on these factors are typically are underreported in the scanty literature that has published on the subject at the primary level.Therefore, the actual primary science classroom situation needs to be observed and the quality of primary science teachers who implement a new curriculum concerning inquiry-based instruction need to be explored for better sustainability of competence-based curriculum.

The main purpose of this study is to explore primary school teachers 'understanding of IBI, their self-efficacy for IBI as well as its actual implementation of inquiry-based instruction in primary science classrooms.

This study was guided by the following research questions:

1. What does primary school teachers' understanding entail about inquiry based instruction in science classroom?
2. What is the level of primary school teachers' Self-efficacy towards inquiry-based instruction in primary science classroom?
3. How is the actual implementation of inquiry based instruction in primary science class?
4. How do teachers' understanding and their Self-efficacy for inquiry based instruction influence its implementation?

METHODS

A mixed methods (Guetterman et al., 2015) The sequential explanatory research design was employed where the quantitative data was collected and analyzed followed by the analysis and collection of qualitative data to address different research questions. This study consisted of two phases; the first phase of the sequence is the generalization of data to the population through survey, and the second phase consisted of a small case study where data was collected by means of semi-structured interviews enabling more insight to be gained into the views of a few selected teachers followed by classroom observation.

Participants

A purposive sample of 100 public primary teachers who taught science in upper primary classes participated in this study. The in-service science teachers, 89 out of 100 teachers were returned back the questionnaires, comprised of 47 males (52.8%) and 42 females (48.2%) from 33 selected public schools from Gasabo, Kicukiro and Nyarugenge districts of Kigali City in Rwanda. By education level, the sample represented 48 degree holders (53.9%) and 41 were non degree holders which is of 46.1 percent represented in the sample.

Instrumentation

A questionnaire that was composed of three sections which are the Demographic information section, primary school teachers 'understanding of inquiry-based instruction, the last one which is primary school teachers' self-efficacy for inquiry-based instruction has administred to 100 public primary school teachers who taught science at upper primary classrooms. For measuring primary teachers' understanding of inquiry-based instruction, the teaching scenario survey instrument was adapted from Kang et al, 2008 as the current instrument for identification of the characteristics that teachers attributed to inquiry-based instruction while they are teaching science. This instrument was developed based on five features of inquiry represented in a standards documents and also based on criteria that every scenario is representing each feature of inquiry and their nature should help the respondent teacher to make attention to the targeted feature of inquiry. 10 items were formulated meaning that every feature was represented twice. The reason that makes the instrument to be useful is that every activity is adapted from primary science textbook used in their everyday teaching, the teachers rated by yes and no with the explanation of their choices and which feature of inquiry is represented by this activity. For measuring the extent of teachers' self-efficacy, teaching science as an inquiry instrument is adapted from Dira-Smolleck& Yoder, 2006 was used. 20 items were composed of 10 items for personal self-efficacy and 10 items for outcome expectancy. The respondents had to answer by 5 points Likert-scale *(1= strongly disagree, 2= disagree, 3= no opinion, 4= agree, and 5= strongly agree).* Participants were not given a precise time for answering the questionnaire in order to obtain the best responses from individual participants. On average respondents took one hour for answering the questionnaire.

Data collection

Before the research could begin, permission for conducting research had to be granted by the Rwanda national research institute, the district director of education was contacted and a letter of approval was sent. The school headteacher for each school of the participants were then contacted, the approval letter was shared which also granted the permission to observe in classrooms. Every signed consent form from participants was collected. Before data collection, an expert review of the questionnaire items and interview questions was completed through a pilot study. As mentioned by Chenail (2011), a pilot study is testing a particular instrument on other individuals with similar context before using it with real participants. During the data collection period, a questionnaire was administered to 100 primary school teachers who taught science and after analyzing the questionnaire, based on their responses 30 primary teachers agreed with conducting face to face semi-structured interview which was arranged and lasting from 8 to 10 minutes in a small safe office for ensuring their responses' confidentiality. Participants were made aware of their rights and were asked if they had any questions or concerns prior to the interview to ensure they understood. Each of the interviews was audiotaped and uploaded to the researcher's personal computer immediately following the interview using no identifying information. Besides the questionnaire and

Table 1. Inquiry based instruction is described by five essential features in science classroom

IBI according to National Research Council, 2000	**IBI according to Rwanda Ministry of Education, 2015**
1. Learner engages in scientifically oriented questions (EQ)	1. Learners pose questions
2. Learner gives priority to evidence in responding to questions (EV)	2. Learners plan investigations and conduct their own experiments
3. Learner formulates explanations from evidence (EX)	3. Learners propose their explanations based on what they think or find out
4. Learner connects explanations to scientific knowledge (EK)	4.Learners construct and test explanations against current scientific knowledge
5. Learner communicates and justifies explanations (EC)	5. Learners communicate their ideas to others

interviews, the participants were also observed teaching a science lesson they believed to be inquiry-based. The lessons varied in length of 40 minutes as prescribed in the curriculum. The participants were asked to provide possible times for the researcher to observe a science lesson delivered using inquiry-based instruction, the researcher silently observed the lesson in the classroom while taking notes on the observation record (EQUIP) and videotaping to be analyzed while checking validity.

Data analysis

The purpose of this section is to extract useful information from the data for making a decision based on empirical evidence (Yin, 2009). The data for this study were prepared according to research questions needed to be answered:

1. Teachers' understanding of inquiry-based instruction, the numerical data were analyzed in Excel and all teachers' responses to short scenarios were read, coded and directly compared to the features of inquiry science classroom separately and then together. During this process, there was a minimum interpretation of raw data. According to Beerer (2004), Inquiry in this study was operationally defined by the essential features detailed in Inquiry and National Science Education and in primary science Rwanda competence-based curriculum (NRC, 2000,p.29; MINEDUC, 2015) was used to determine which responses were consistent with particular essential features of inquiry represented by that statement scenario.
2. Teachers 'self-efficacy for inquiry-based instruction responses were analyzed and examined from the questionnaire using descriptive statistics in SPSS 25 package program. Reliability was assessed with Cronbach's alpha (0.885). Validity was checked with principal axis factoring using the Quartimax rotation method where two factors were extracted with the suggestion of factor loading with Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.842).
3. The actual implementation of inquiry-based instruction lessons was analyzed and decided using the Electronic Quality of Inquiry Protocol (Marshall, et al., 2010) which was shown to successfully measure science teachers' quality of inquiry teaching. The EQUIP consists of 19 indicators divided into four factors to evaluate inquiry-based instruction: (1) Instruction, (2) Discourse, (3) Assessment, (4) Curriculum. For each factor of inquiry is divided into Pre-inquiry (level 1), Developing inquiry (level 2), Proficiency inquiry (level 3), and Exemplary inquiry (level 4). The EQUIP is aligned with NGSS's emphasis on science practices through its emphasis on students' discourse, students 'engagement in argumentation and in-depth better understanding of the concepts than memorization (Bybee, 2014). The researcher and two science education researchers were trained on EQUIP through a set of training videos provided on the EQUIP website, the training continued until all raters come to 95% of agreements without comparing their scores. All inquiry lessons were scored with one of these researchers.

4. The influence of teachers' self-efficacy for inquiry-based instruction on their implementation analyzed based on the agreement samples. Independent T-test was conducted to measure the significant difference between two groups that emerged based on their inquiry-based instruction implementation in the science classroom and their self-efficacy for inquiry.

The qualitative data from interviews and explanations from the writings of participants 'scenario responses, the researcher should be familiar with the data collected by transcribing and coding them manually (Twining et al.,2017). Also he suggested that the next step was to connect codes amongst them. Those codes merged from new ones, identified and became the patterns, and later became categories . From there, the data were examined for the identification of the overarching themes and connect these themes to the research questions.

RESULTS AND DISCUSSION

This study aims to identify the primary teachers' understanding of IBI, extent of primary teachers' self- efficacy for inquiry, the primary teachers 'actual implementation of IBI, and the influence of teachers 'self-efficacy for IBI on its implementation. Teachers 'understanding of IBI were examined using science teaching scenario, teachers 'self-efficacy for inquiry was examined by teaching science as inquiry and finally, their implementation of IBI was rated using Electronic Quality of Inquiry Protocol (EQUIP).

Primary Teachers' understanding of Inquiry-Based Instruction

In this study, teachers' understanding of classroom inquiry was defined in terms of the characteristics they used in identifying inquiry activities. Those characteristics were, in turn, compared with those presented in the standards documents and in the primary science curriculum of Rwanda (NRC 2000; MINEDUC, 2015). Finally, we studied what the inquiry teaching scenarios could reveal about teachers' understanding of classroom inquiry. The first step was to choose if activity was represented inquiry classroom by YES or NO answer.

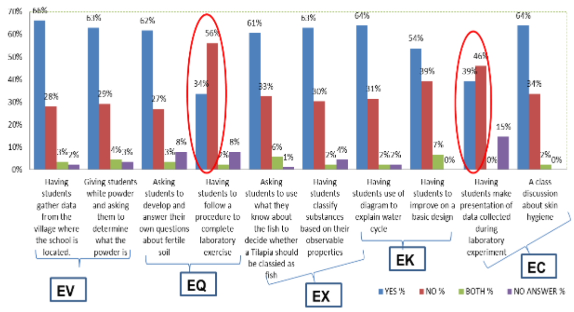

Figure.1 Participants' choices about teaching science scenario activities

Based on the above graph, respondents chosen whether the activity represent features of inquiry in science classroom and matched that activity with the represented feature.

Table 2. Explanations of teachers' choice of responses to scenario

FEATURES OF IBI	Q1 (EV)	Q2 (EV)	Q3 (EQ)	Q4 (EQ)	Q5 (EX)	Q6 (EX)	Q7 (EK)	Q8 (EC)	Q9 (EK)	Q10 (EC)	Frequency
Engaging with scientific oriented question (EQ)	4	5	37	2	0	0	2	0	0	1	51
Give priority to evidence (EV)	1	1	0	0	0	0	0	0	0	0	2
Formulating explanations based on evidences (EX)	0	1	0	0	0	0	0	0	0	0	1
Evaluating explanations in connections with scientific knowledge (EK)	0	0	0	1	0	0	0	0	0	0	1
Communicating explanations(EC)	2	0	0	0	0	0	0	0	0	2	4
Importance of activity	17	17	14	15	21	8	24	8	23	40	187
Scientific reasoning	0	0	0	0	1	2	1	0	0	0	4
students centered	12	5	7	9	30	26	19	31	11	24	174
No laboratory	0	3	4	30	19	0	0	19	30	0	105
No information about IBI	28	17	16	11	11	38	20	13	8	11	173
Blank page	25	40	11	21	7	15	23	18	17	11	188
TOT	89	89	89	89	89	89	89	89	89	89	890

Around 66% of respondents chose YES and their explanations did not reflect the features of inquiry, instead, they explained that the activity is very important in the science classroom. For clarifying this finding, the researcher has transcribed and coded the explanations from respondents' choices and developed the themes and categories which they corresponded with their answers. An example of the statement" Having students gather data from the village where the school is located". For this 25 teachers failed to explain the reason behind their choice left the question blank, 28 teachers Cleary said that they did not have information, 17 teachers explained this statement in relation with its importance in science classroom, 12 teachers said that is a students centered approach, 4 teachers explained it as engaging with scientific orientated question as one of the inquiry features, 2 said that it is a communication as also one of the features of inquiry. Only 1 teacher explained his choice by clearly mentioning that this statement as a search for evidence or facts for answering the question asked by teacher.

In responding to the scenarios by portraying and telling inquiry activities, all of the teacher participants used more than one essential feature of inquiry. In particular, the feature of engaging in scientifically oriented was used to characterize the inquiry science classroom in 22% of responses at a very high frequency. Other features like, giving priority to evidence was mentioned at 1% by respondents, Communicating explanations (EC) was mentioned at 1%. Unfortunatutly features like Formulating explanations based on evidences (EX) and Evaluating explanations and connecting to scientific knowledge (EK) are lacked in respondents'explanations. On condition that the respondent mentioned the feature of inquiry we recorded it on every activity so that we calculated the incidence of the mentioned feature, finally, we concluded with the graph showing the presence correct mentioned features of inquiry science classroom in participant's responses.

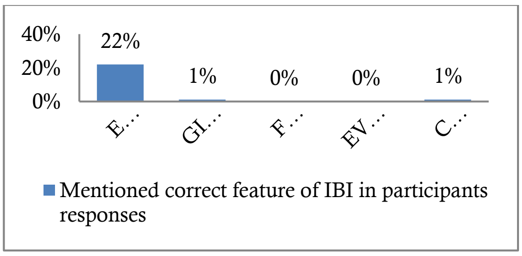

Figure 2. Features mentioned by participating teachers

This graph showed that teachers' understanding of inquiry-based instruction was incomplete. The teachers' responses are missing some features like features of formulating explanations based on evidence (EX) and evaluating explanations in connection with scientific knowledge (EK) in teachers 'responses.

The results of primary school teachers 'understanding of inquiry-based instruction revealed that this group of primary teachers demonstrated an incomplete understanding of inquiry-based instruction. These teachers used questions as one component of inquiry-based instruction and their knowledge was limited by there. They failed to connect all of the components of inquiry-based instruction as the vehicle of the entire learning and teaching process which leads to the incomplete comprehensive list of components of inquiry science classroom in their understandings. . The results of this study also showed that teachers have inadequate knowledge of how to implement this method. Based on interview responses and scenario answers, it is evident enough that teachers have a scarcity of other components besides the feature of question and that question not promotes the investigation process. These findings coincided with other existing literature which reported that there is a gap between characteristics of inquiry perceived by teachers, their understanding about it and inquiry-based instruction in ideal science reform (Kang et al, 2008; Blevins, 2017; Morrison, 2017). The first step of understanding of inquiry is to know the features of inquiry science classroom. The second step is to know how to connect with each other and the final one is to connect those features of inquiry and the science content so that learners gain more understanding of the concept and use scientific skills (NRC, 2000; Montero& Tuzón, 2017). Based on the results of this study it can be concluded that those teachers do not understand inquiry-based instruction.

Primary teachers' self-efficacy for inquiry-based instruction

The mean score of teachers 'self -efficacy was 3.82, this mean falls in high rating, the reason why the level of primary teachers self-efficacy was high. The factor analysis was conducted as a data reduction technique for the instrument used to measure teachers 'self-efficacy for inquiry-based instruction. (Bandalos & Finney, 2010) Assumption is that extracted factors would have a nonzero correlation. We used Principal Axis Factoring (PAF) as an extraction method with Quartimax with Kaiser Normalization rotation method and a conservative cut-off greater than 0.4 determined important factor loadings of items. For variables loading on two factors were assigned the factor with high loadings, items that did not load on each of two factors were discarded to refine and reduce the scale.

Table 3. Teachers 'self- efficacy for IBI Factor loading

Factor loaded of teachers' Self-efficacy toward IBI Items (KMO: .842)				
Item	**statements**	**Correlation coeff.**	***Factor***	**Cronbach's Alpha**
E01	I am unable to provide meaningful common experiences from which predictable scientific questions are posed by student	.926	Efficacy 1	.971
E02	I am able to create most of the scientific questions needed for students to investigate	.834		
E03	I am able to facilitate open-ended, long-term student investigations to provide opportunities for students to gather evidence	.689		
E04	I am able to utilize worksheets as an instructional tool for providing a data set and walking students through the analysis process	.665		
E05	I am able to provide students with the opportunity to construct alternative explanations for the same observations	.877		
E06	I am able to provide my students with explanations	.854		

E12	My students investigate questions I have developed	.565	Efficacy 2	.791
E16	My students comprehend when I presented explanations. That is my expectation to them.	.546		
E17	I expect students to develop explanations using what they already know.	.704		
E18	I expect that my students can evaluate their explanations that they have been collected during investigations.	.773		

The results revealed that variable loadings as two factors which are efficacy 1 and efficacy 2 were given the following names efficacy 1 with 6 items representing **Personal self-efficacy** and efficacy 2 with 4 items also representing **Outcome expectancy**. PAF reduced the total number of items describing teachers 'self-efficacy for inquiry classrooms from 20 to 10 items. The internal consistency reliability Cronbach's alpha for efficacy 1 was 0.971 and efficacy 2 was 0.791. the results revealed that teachers' Outcome expectancy was lower than their Personal self-efficacy for inquiry-based instruction. A t-test and ANOVA were conducted for assessing the effect of demographic information (gender, age, teaching experiences, qualification, and highest degree held by the teachers) on teachers 'self-efficacy for inquiry-based instruction. The results revealed that there no significant effect of primary teachers 'demographic information on primary teachers 'self-efficacy for inquiry-based instruction.

Teachers 'self-efficacy seems to be greater than outcome expectancy across all five features of inquiry-based instruction. Previous studies have not assessed in-service teachers' self-efficacy for inquiry-based instruction in science classrooms based on five essential features of inquiry-based instruction (Smolleck & Mongan, 2011). The teachers 'self-efficacy for inquiry-based instruction did not differ significantly based on their demographic factors studied such as gender, qualifications, having a degree or not, teaching experience, age, and the number of students. These results suggested that teachers 'self-efficacy is important but alone is insufficient to make inquiry-based instruction happen in the science classrooms . This lack of correlation between teachers' self-efficacy for inquiry and their teaching experience, their qualifications and the highest degree bring into question whether the teacher-education programs and professional development are serious for effective teaching if empty of exact pedagogical instruction (Marshall et al., 2016).

From the interview results, it can conclude that only 2 teachers out of 30 teacher's participants have insufficient understanding of IBI while others lacked understanding of IBI. The relationship between teachers 'understanding and teachers 'self-efficacy showed that teachers with high understanding of IBI their self-efficacy for IBI was declined based on association of the huge challenges they attributed to inquiry in science classroom. All participants teachers feel confident to teach with inquiry and showed the challenges associated with IBI implementation. Some teachers showed the positive intention for training about IBI while others have not showed interest for being trained.

Primary school teachers 'actual implementation of inquiry-based instruction

As the inquiry teaching was observed through videos recorded. The agreement of scores between three raters using Electronic Quality of Inquiry Protocol (EQUIP) became to 95%, the results were presented from 20 teachers. Based on the scores given, means and standard deviations were calculated for every teacher for each factor (Instruction, Discourse, Assessment, and Curriculum) as well as the summative score of all 19 items or indicators. The teachers' level of actual implementation of inquiry and the quality of inquiry implemented was assessed through EQUIP.

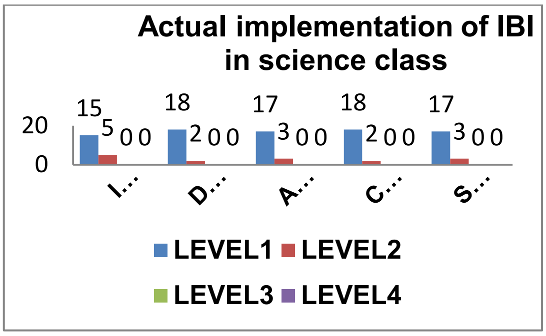

Figure 3. Primary school teachers' actual implementation of IBI in science classroom

This figure showed that the mean scores of each factor ranged between level 1 and level 2. After considering four factors, only 3 teachers out of 20 teachers observed have performed developing inquiry (level 2), and 17 teachers have allocated in pre-inquiry (level 1). This performance is not aligned with the national science standards document as described by Marshall et al., 2010. When examining the teaching practices of those teachers, they predominantly implemented a teacher-directed pedagogy. The level 1 tends to be more traditional where students tend to be the recipient of knowledge, the use of lecture and didactic styles of teacher questioning, and initiate response follow-up was evident. Learning was focused on rote and memorization where the teachers used to spell the keywords and emphasize correct answers and rewarding them. For those who performed level 2, where students were worked busy with activities related to the concepts, but students were not largely required to think deeply, and those activities also tended to be dominated by prescriptive forms of learning. Those strategies used in that class observed are initial observations and questioning followed with the rewarding from the teachers. Most of the time teachers use questions and answer method for checking students' progress and probing for their understanding. The teachers engaged students in activities with the purpose of rote memorization of facts, drills and practices and just for skill automation. No inquiry attempted within 17 teachers. The observations result across all four factors showed the following:

The instructional factors were characterized with teacher-centered dominant in explain the concepts; students were passive by taking notes or discussing by their own which lead to the learning for mastery of the facts.

The discourse factors showed that students did not engage with the questions which challenged them above remembering level; the questions focused only on correct answer and the teachers rewarded the best answers by asking other students to make some drills for best; the communication was just under teachers 'control.

The assessment factors indicated that teachers did not assess the prior knowledge for the students; the concepts gained through memorization and repetition; formal and informal assessments were for measuring factual knowledge, did not requiring even little explanations.

The curriculum factors indicated that the lessons provided the superficial content, did not engaged the students only focused on content. The information was recorded through prescriptive ways.

According to the results, the actual inquiry implementation level did not reflect the five essential features of IBI. From classroom observations, the teachers' implementation of IBI was low. This showed that IBI is not even theoretically adopted. Most of the teachers are still in pre-inquiry stage which means that teachers are not familiar with getting students to be actively engaged and the students did not involve in thinking activities. To some extent, students are physically engaged with prescribed steps. In observed lessons teachers did not use any essential feature of inquiry, only they tended to put learners in a group where the learners used only observation skills. Although teachers used to describe inquiry-based instruction by questions, the results revealed that none of the lessons used scientific questions which cannot help students to investigate the phenomena for improving their scientific knowledge and thinking. Limited questions that forced students to answer correct and short answers with the guidance of agreement between teacher and students were also reported as teacher-led responses by Ikeda and Matsubara in 2017. A questioning technique was not effective, students did not ask any questions, they only answer teachers 'questions in a systematic way where the teacher showed the intention of how he wants them to answer. An example is where a teacher asked a student to come in front by using a figure of the circulatory system his showed the location of the heart and after showing it the teacher asks other students to clamp for him. That all. No additional question for challenging them. As it is known that the inquiry science cycle starts with a question and students engage with that question for finding out the answer, in this study the cycle did not observed based on those types of questions used. It can be concluded from the results of this study that most of the teachers got to level 1 which is characterized by traditional teacher dominated lessons where students were passive, recipients of knowledge given by the teacher. Few of them were level 2 where students were busy in physical activities dominated by prescriptive forms of learning. Students followed step by step after the reception of the concept, it seems like lessons were active and fun but not promoting inquiry-based instruction. These types of inquiry-based instruction implemented are not in line with the real inquiry described by Marshall et al. (2010).

The influence of Teachers' understanding and Teachers 'self-efficacy for inquiry-based instruction on its implementation

The findings of this research showed that it was better to consider the distributions' score of implementations of inquiry-based instruction in science classrooms. Consequently, the distribution score has been ranged into a group which was level 1 and level 2. This showed that the scores were not distributed normally. We conducted t-test for comparing the mean values of teachers' self-efficacy for inquiry of two groups resulting from teachers 'implementation of inquiry-based instruction (level 1 and level 2). The results showed that means of two groups are not significant different.

Table 4. Factors predicting implementation of IBI

Variables in the Equation	B	S.E.	Sig.	Exp(B)
Age	.328	.677	.628	1.389
Gender	-.894	1.520	.556	.409
Qualification	-10.234	10048.243	.999	.000
Teaching Experience	-.321	.495	.516	.725
Degree	-.522	1.385	.706	.593
Number of Students	.155	.204	.447	1.168
Teacher' understanding of IBI	.225	.406	.580	1.252
Teachers' self-efficacy	-1.210	1.355	.372	.298

These results showed the evidence that there no factors predicting the actual implementation of inquiry-based instruction in the primary science classroom among demographic information, teachers' understanding of IBI and their Self-efficacy for IBI. During the interview, teachers were shared their understanding of how inquiry-based instruction should be implemented in the science classrooms, but these understanding may not be matching with their actual classroom implementation. And those teachers with high or low self-efficacy for IBI, no one make a difference in implementation.

The findings of this study revealed that, the actual implementation of inquiry in the science classroom are confirmed with their understanding of inquiry wherein they interview, teachers did not include in their explanations what inquiry is, what inquiry looks like in a classroom setting and strategies used to implement inquiry. Teachers' understanding of inquiry includes the ways to implement it. Similar findings reported in several studies (Kang et al., 2008; Wee at al., 2007 and Lotter et al., 2013). In the teachers, understanding of inquiry-based instruction lacked the essential features of inquiry science classroom like engaging with scientific orientated question which is dealing with high order thinking skills, students participating in collection and analyzing data, and judging the evidence and explanations based on previous knowledge. This understanding reflects what was happened in the science classroom. It means understanding is the beginning step of the implementation of inquiry. It can be concluded that primary teachers 'low implementation level of inquiry in the science classrooms was affected by their understanding of inquiry-based instruction. According to (Chichekian et al., 2016), teachers 'understanding of inquiry-based instruction intervene as a barrier to implementation in this study. For teacher's self-efficacy for inquiry-based instructions were high. The expectation was that their implementation will be high for all five essential features of inquiry. Existing literature reviews have reported that high self-efficacious teachers tend to implement effective inquiry-based instruction in the science classroom (Kimber et al., 2012; Smolleck and Mongan, 2011). Teachers with high self-efficacy try new teaching methods, modify the current ones, and persevere to the challenges they may encounter (Seetensen, 2011). Teacher with high self-efficacy is motivated to try inquiry (Marshall et al., 2007). Surprisingly, the results of this study contradicting these previously reported. Both, teachers with high self- efficacy and low self-efficacy for inquiry-based instruction are implementing the same level of inquiry in the science classrooms that is a low level. No difference significance found between the implementation level of inquiry and either teacher self-efficacy or outcome expectancy. On another hand, this study agrees with the study reported that high efficacious teachers are more probably resist reform practices, inquiry-based instruction is one among reforms (Kahveci, Monsour and Alarfaj, 2018). For example, teachers with high self-efficacy showed low effort in creating students centered environment, they demonstrated low commitment for implementing reform where they did not engage their students in reform-based practices (Favre and Knight, 2016). Understanding of inquiry might arbitrate between self-efficacy and inquiry implementation, sometimes like a facilitator, sometimes like a barrier (Chichekian et al, 2016). In this study the way teachers understand what inquiry is and how to implement it in science classroom became a barrier for its implementation; even though teachers rated themself how they perceive to implement inquiry at a higher level when it came to enactment in science classroom through observation, their perception is socially desirable rather than what might be the concrete case.

Apart from, science teachers' understanding and self-efficacy towards inquiry-based instruction, this study also investigated the association among teachers' demographic data (gender, age, qualifications, highest degree, number of students, and teaching experience), teacher's self-efficacy towards inquiry implementation. The evident finding showed that none of these factors made a significant difference in teacher implementation of inquiry-based instruction. The results found that no significant effect was noted between teaching experience, highest degree earned and inquiry-based instruction this finding coincides with the previous done (Marshall et al., 2007). This lack of effectiveness brings professional development and teacher-education programs into a question. There is a need related to the quality of professional development and the teacher-education programs in this regard with Rwanda. The results found that no significant effect associated with the qualifications of teachers in science or those who have a non-science certificate. This finding is conflict with previous studies (Seneviratne et al, 2018, Marshall et al, 2007). Additionally, no significant effect found between gender and implementation of inquiry supports the previous study by (Asiri,2018). In this study, we failed to test the significance effect between professional development and teachers' implementation of inquiry-based on results from the interview where all participants reported that they have not received the training related to the inquiry. Most of them mentioned that they heard about this through this research. Previous studies asserted that what matters to make a significant change in implementing inquiry-based instruction is the quality of professional development for in-service teachers related to inquiry-based instruction (Lotter & Thompson, 2018)

CONCLUSION

This mixed study was designed to uncover primary school teachers' understanding of the components of inquiry-based instruction, their self-efficacy about IBI in their science classrooms, and the actual implementation. The findings of this study aim to add to the existing body of literature in the field of leadership in educational administration by providing insight on the existing needs of primary school teachers as it relates to implementing inquiry in their classrooms. Identifying the challenges of primary school teachers potentially provides administrators a deeper understanding of how to support teachers in addressing those challenges through the use of ongoing professional development. The findings of this study determined that teachers understood the benefits of inquiry-based instruction but lacked the knowledge of how to implement inquiry. The teachers in the study demonstrated high -self-efficacy for IBI but they did not implement inquiry successful inquiry. Many of the teachers explained that professional development on the topic of inquiry has not been existed these districts. However, due to the perceived benefits of utilizing inquiry instruction, many of the teachers would be interested in attending professional development to learn more about inquiry-based instruction.

Implications for practices

The poor understanding of inquiry-based instruction for those primary teachers should be a call to action to the science teacher education and professional development programs. Such teachers may not implement effective, the science competence-based curriculum in their classroom as intended to be implemented because of their poor understanding. The teachers who have a poor understanding of inquiry-based instruction cannot implement it. In-service teacher training and pre-service teacher education should focus on their science education course by focusing on five essentials features of inquiry science classrooms for addressing this gap. There is a need to be sure that teachers should be trained sufficiently on how to teach and what to teach by inquiry for achieving the objectives of the competence-based curriculum.

Based on our results, we believe that the highest degree earned by the teachers; qualification, teaching experience and level of their self-efficacy towards inquiry-based instruction are all significant factors that related to the implementation of inquiry-based instruction in the science classrooms. Several implications result from these findings. First, in-service teachers training programs that lack long-term sustained commitment to change are unlikely to significantly affect teacher practice (Supovitz & Turner, 2000). Since no significant correlation between numbers of years taught, highest degree earned, and teachers' self-efficacy for inquiry and implementation of inquiry-based instruction was noted, possible explanations should be happening:

1. Pre-service teacher training programs have been not fruitful in recent years at implementation of inquiry
2. Pre-service and in-service teachers are growing negatively at an equal level towards their views and abilities to implement inquiry
3. Shift of policy alone would be insufficient for meaningful implementation of inquiry in the science classrooms.

Despite the government stipulates inquiry-based instruction in implementing the competence-based curriculum, the teachers 'self-efficacy was high when it became to actual implementation, the inquiry implemented was not correct in sense of their self-efficacy. No difference found between teachers with high and those with low self- efficacy all of them implement it poorly. The various explanations possible:

1. Shift of teacher self-efficacy and implementation of inquiry-based instruction to challenges identified by the teachers and influences from contextual variables
2. Teachers' choice of teaching method which can be used in the classroom is successful when the curriculum reform shaped and transformed by teachers' beliefs and their understandings of the local context (Keys and Bryan, 2001)
3. Only the implementation of inquiry-based instruction is durable when the voices of researchers are in meaning with the voices of teachers to creating matched reform-based instruction. There is a hope that teachers' once muted voices will be raised loudly and clearly in the call to reform the challenges faced by the teacher while implementing inquiry will be handed.

Recommendations for further research

This research study was designed to study teachers' knowledge of the components of inquiry and their understanding of how to teach implement those components of inquiry, their self-efficacy toward this approach and actual implementation of inquiry in science in primary classroom. It was determined that the participants in this study did not understand the components. Even if their self-efficacy was high, they did not implement inquiry. This finding suggests further research should include a study of teachers who have successfully learned the aspects of inquiry and are implementing inquiry regularly. Studying these teachers could provide information on the causes behind their low level of implementing inquiry in order to support other teachers in this process. It would also be beneficial to study and compare the outcomes of various professional developments dealing with inquiry instruction and their sources of self-efficacy to flesh out the most beneficial professional development opportunities. This information could be used to champion the creation of professional development that would benefit science reform and develop a deeper understanding of inquiry-based instruction and its components. Finally, conducting this study on a larger scale including all primary grades could provide a more complete view of teachers' comprehension of inquiry across various grades levels. These suggestions for further research have the potential to provide prosperity of information to leaders in educational administration as to how to support their teachers in developing an understanding of the successful implementation of inquiry-based instruction. Future research should extend to a large sample of the participant including pre-service teachers and students. In-service teachers who are teaching lower levels should be examined by considering other provinces.

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