Journal for the Education of Gifted Young Scientists, 8(3), 1291-1304, Sept 2020
e-ISSN: 2149- 360X
jegys.org

youngwisepub.com

Research Article

The effectiveness of video-based interaction on professional science teachers to improve elementary school students achievements

A.A. Ketut Budiastra[1], Iwan Wicaksono[2], Nia Erlina[3]*

Faculty of Tarbiyah and Teacher Training, Institut Agama Islam Negeri Jember, Indonesia

Article Info

Received: 6 April 2020
Revised: 15 August 2020
Accepted: 28 August 2020
Available online: 15 Sept 2020

Keywords:
Video-Based Interaction
Professional science teacher
Elementary school
Students' achievements
Inquiry

2149-360X/

Abstract

The process of interaction as a follow-up package in the process of video-based tutorials effectively toward professional teachers. This study aimed to analyze the effectiveness of VBI in Teacher Working Group (TWG) forums to improve elementary school students' achievements. Interaction is the follow-up phase of effective teaching and learning activities using video by professional teachers. This study analyzed the effectiveness of Video-Based Interaction (VBI) in a teacher forum in improving elementary school students' outcomes in science learning. This study was carried out in the context of distance learning by applying the inquiry approach to support teachers' pedagogical competence. The samples were 36 professional teachers and 432 students who were purposively selected. This study used one group pretest-posttest quasi-experimental design. N-gain <g> was employed to analyze the learning process in improving students' learning outcomes. The results of the analysis indicated significant and consistent increases in students' learning outcomes of high, high, high, and moderate scores for n-gain categories of memorizing, understanding, applying, and analyzing, respectively. Teacher professionalism also contributed to students' excellent learning outcomes. Positive teacher and student responses to the effectiveness of VBI helped teachers and students to improve competencies that have to be achieved by describing video-based interaction and inquiry-based learning in general.

To cite this article:
Budiastra, A.A.K., Wicaksono, I, & Erlina, N. (2020). The Effectiveness of Video-Based Interaction on Professional Science Teachers to Improve Elementary School Students Achievements. *Journal for the Education of Gifted Young Scientists, 8*(3), 1291-1304. DOI: http://dx.doi.org/10.17478/jegys.715139

Introduction

The teacher is a profession that deals with the provision of education for nations' future generations; thus, teachers must improve their competence as professional teachers. Professional teachers also have intense patriotism for the government that includes the aspect of core competence (expertise), social responsibility, and solidarity (esprit de corps) (Debarger et al. 2017). In teaching the students, teachers need to apply instructions that are effective for students in the 21st century. Teaching and learning activities that involve students' active cognitive participation will create comprehensive teaching and learning (Strouse, Nyhout & Ganea, 2018). Professional teachers have the capability in education, classroom management, cooperation with senior teachers and school principals, and have the freedom to create a democratic environment (Qadeer, Tahir & Chishti, 2018). Teachers who can align pedagogical strategies with the demands of curriculum development can work effectively in schools (Valdmann, Holbrook & Rannikmae, 2017).

Teachers are supporting factors for a good education. However, the initial evaluation indicated that the number of professional teachers is still low (Budiastra, Erlina & Wicaksono, 2019a). This might be influenced by the

1 Doctor, Faculty of Teacher Training and Education, Universitas Terbuka, Indonesia (budiastra@ecampus.ut.ac.id), Orcid no: 0000-0001-5478-753X
2 Doctor, Faculty of Teacher Training and Education, Universitas Jember, Indonesia (iwanwicaksono.fkip@unej.ac.id), Orcid no: 0000-0003-0717-1577
3 Doctor, Faculty of Tarbiyah and Teacher Training, Institut Agama Islam Negeri Jember, Indonesia, (nia.erlina1@gmail.com), Orcid no: 0000-0003-2199-5046

education of prospective teachers, where prospective teachers were not yet ready to attend teacher education due to their doubts about teaching careers (Jatmiko et al. 2018). Whereas, teachers who have been actively teaching have the opportunity to utilize information and resources to enhance their talents from books or through conceptual change experience (Brauer & Wilde, 2018). The Teacher Working Group (TWG) is an available source of information to increase teaching ability. However, the teacher did not participate in it. So far, the role of TWG is not optimal in preparing future teachers (Hoisington, 2018). Whereas in fact, facilities and program activities according to the curriculum can be activated for professional teacher training (Appleton, 2002). Training and debriefing enable teachers to adapt to the information society, learning society, and transformation in technology (Aksakalli, 2018). Changes in teaching career environment can affect teachers' academic talent (Szabó & Révész, 2018).

Teachers can improve their professionalism in the classroom through a series of stages in the tutorial model for teachers. The Video-Based Interaction (VBI) tutorial model effectively enhances professional teachers by involving the process of interaction as a process of elaboration of comprehension within TWG forum and distance learning (DL) (Budiastra, Erlina & Wicaksono, 2019b). VBI uses video media to foster teachers' pedagogical competence. Teachers can share experiences and provide mutual assistance and feedback in more professional learning activities through teacher working group deliberations (Boonsue, Jansem & Srinaowaratt, 2015). VBI regards the TWG forum as an implementation of elaboration after the teacher listened to the video independently. The integration distance learning in the application of VBI serves as a means to share the tutorials for teachers in remote areas who have limited access to increase their knowledge (Davis III, Brestan-Knight, Gillis & Travis, 2018). Engagement with teaching videos is an introspection for teachers to equate perceptions and provide space for sharing thoughts, intentions, and experiences to achieve skill goals (Bae, 2012). In line with this context, learning can be done by observing others. It means that the teacher can watch the video and learn how to teach according to these observations (Slavin, 2019). The use of video in VBI ensures the accessible model teaching practices that are accessible to teachers and makes the dissemination of information in the new curriculum effectively (Dieker et al. 2009).

Professional Science Teachers can present comprehensive teaching by enhancing students' active cognitive role (Strouse et al. 2018). Besides, Professional Science Teachers can apply teaching methods that are appropriate to the characteristics of the learning materials and student development. Science subject emphasizes the students' active role to independently engage with the experimental activities that focus on developing basic science, knowledge, skills, and perspective (Dow, 2006). The learning model plays a role in controlling the cognitive and learning process (Pintrich, 2004). In the elementary level of education, students' learning achievement in science subjects is related to the learning model used. A study shows that elementary students got a little guidance in the learning process and attain weak metacognition. Nonetheless, they can develop their metacognitive training (Dignath, Buettner & Langfeldt, 2008). The given exercises have to be in line with the curriculum, especially those in science education (Holbrook & Rannikmae, 2007). Curriculum reform continues through the optimization of professional teacher community members and Next Generation Science Standards (NGSS) to prepare science learning and literacy that is integrated with information technology (Valdmann et al. 2017). Elementary students are the successors of the science education development at the primary level who need to be engaged in meaningful learning experiences. Younger students have limited ability to express information processing about science concepts verbally. However, students who have a better learning experience will be able to describe information about the science concept as a whole (Gnidovec & Torkar, 2019). NGSS shows changes in instruction used in science education lead to inquiry skills (Hoisington, 2018). Meaningful and contextual learning supports science learning, where inquiry-based learning is recommended as one of the promising methods to understand the science concept correctly (King & Henderson, 2018). Constructivism in the inquiry process makes learning meaningful (Erlina, Susantini, Wasis & Pandiangan, 2018).

Various inquiry processes are categorized into confirmation inquiry, structured inquiry, guided inquiry, and open inquiry. Each difference lies in the teacher's responsibilities and student activities (Levine, 2019). Inquiry-based learning is active learning, which significantly influences the achievement of science learning, reduces confusion. Also, it is more challenging and exciting that it encourages students to complete the tasks (Kaya & Kablan, 2013). In science subjects, inquiry involves the activities of students in compiling scientific ideas, knowing how researchers research, giving opportunities to conduct investigations, and conducting experiments. In experimental activities, students can design science activities, predict experimental results, and evaluate their comprehension. The results

showed that elementary school students still need teacher and laboratory assistant to support them in creating conducive science learning (Smrečnik, Fošnarič & Čagran, 2014). A total of 32.8% of teachers used guided inquiry to teach science (Ngaisah, Ramli, Nasri & Halim, 2018). Other relevant research showed that instruction-based teaching has been useful to be used in science teaching and learning based on the latest advancement in technology.

Even though it is set as a science learning standard, inquiry-based learning has not been entirely carried out (Erlina, Susantini & Wasis, 2018). The inquiry has become the basis of the curriculum as a learning model that has to be applied. However, teachers still choose to use lectures and assignments without guidance (Kaya & Kablan, 2013). The facts show that 22.65% of science teachers even used teacher-centered learning for science teaching. Teachers tend not to have enough courage to play the role of learning facilitators. The teaching process carried out is one-way by asking questions and waiting for student responses (Ngaisah et al. 2018). In line with teacher effectiveness, recent research has argued that teacher contributions to student academic background, teacher professionalism, and their classroom practices (Shannag, Tairab, Dodeen & Abdel-Fattah, 2013). Professional teachers need to be aware that beliefs affect their performance. Thus, teachers have to develop good learning and teaching ideas to support the construction of students' knowledge (Brauer & Wilde, 2018). An interesting fact is found when ten teachers who were asked about their perspective on inquiry had ten different answers. Even researchers had difficulty assessing inquiry-based learning because it can look very different from one classroom to the other classes (Harlen, 2013).

Professional Science Teachers who have attended VBI training are expected to be able to help improve elementary school students' learning achievement. VBI supports Professional Science teachers to enrich their literacy, develop lesson plans, strategies, environment, and relevant media to improve students' learning achievement (Laverick & Paquette, 2017). This tutorial can support science teachers to understand better ways of teaching science in elementary school and integrate "science courses with methods of teaching" (Hinduan, 2001). Teachers need to place children as investigators and active thinkers of science information (Hoisington, 2018). In line with the importance of making students productive learners, VBI can stimulate students' cognitive skills to answer important questions such as, What is the brightness level of the lights arranged in series and parallel? The analysis of students' achievement showed 95% of students believed that questioning activities gave them more opportunities to practice thinking and to analyze (Weganofa, Pratiwi, Liskinasih & Sulistyo, 2020). This study stimulated students' cognitive skills in electricity and water topics. The selection of this topic is reviewed based on its relevance to students' daily lives. Besides, the presence of abundant tools and materials has not been fully used as a source of teaching innovation to support student activity (Dignath et al. 2008). Professional science teachers can plan topic questions, documents and procedures, simple tools for observation, inquiry-based scenarios, and evaluations that support science learning outcomes in elementary schools.

From previous research data, it has shown that VBI is effective in improving teacher professionalism in teaching science (Budiastra et al. 2019b). VBI has a direct impact on aspects of teacher professionalism. This research is the final stage of the learning cycle which consists of (1) analyzing videos; (2) determining topics in the curriculum; (3) preparing lesson plans according to the subject; (4) discussing the draft of the lesson plan in the TWG group; (5) simulating enactment of the lesson plan draft in the form of peer teaching; (6) reflecting on the peer teaching; (7) implementation in each teacher's class and (8) evaluating the improvements. This stage supports the perception that if teachers are trained to teach predominantly in lectures, teachers tend to teach their students in a similar way (McDermott, Shaffer & Constantinou, 2000). The results of the current study indicate the effectiveness of VBI indirectly in improving student learning outcomes. Research evidence shows that schools that have professional teachers can produce effective teaching and more superior educational results (Dragoş & Mih, 2015). The data in this study came from the same research as previous studies, but the data subjects studied were different. This study produces more comprehensive information that the professionalism of teachers is not only achieved in the aspects of planning, implementation, and relations, but also in improving student learning outcomes effectively. What is new in this research is that teachers who teach are exceptional teachers who meet professionalism and are active in TWG. Student learning outcomes not only increase, but also foster students' assumptions that science is fun can be realized in this study. The effectiveness of VBI can be seen indirectly from the increase in n-gain in students who learn, even though the location of this learning occurs in rural and urban areas.

Problem of Study

This research was done based on facts from other research showing that VBI is effective in increasing professional teachers in teaching science (Budiastra et al. 2019b). The results of this research need to be followed up with the

implementation of VBI in improving elementary school students' achievement in learning science. The problems of this research include the need to analyze the effectiveness of professional teachers in implementing VBI to enhance elementary school students' achievement in learning science. The analysis consists of;

- Is there a statistically significant effect on elementary school students' achievement before and after the learning process?
- What is the category of elementary school students' achievement after learning activities with professional teachers?
- Are there differences in elementary school students' achievement?

Method

Research Design

This study employed pretest and posttest with replication design, namely O (Pretest) X (Treatment) O (Posttest), (Fraenkel, Wallen & Hyun, 1993). Replication involved two groups, students who live in rural and urban areas. The pretest was conducted with students before learning, and the posttest was carried out after learning with teachers who have met the standards of professionalism.

Table 1.
Implementing of Research Design

Group	Design			Topic
G1	O_1	X_1	O_2	Water
	O_1	X_2	O_2	Electricity
G2	O_1	X_1	O_2	Water
	O_1	X_2	O_2	Electricity

O_1= Measurement of pretest, O_2 = Measurement of posttest X_n = Treatment

Participants

A total of 36 professional teachers and 432 elementary school students were divided into two test groups involved in this research. This research was conducted in 18 elementary schools in grades five and six. The samples were selected using purposive sampling, where samples required had specific requirements according to the objectives of this study (Annan, Adarkwah, Abaka-Yawson, Sarpong & Santiago, 2019). The students had homogeneous initial abilities, and professional teachers taught them. This study was conducted for ten months in Tabanan, Bali (G1), and East Belitung, Bangka Belitung (G2) Indonesia. This study involved senior lecturers as education experts and senior teachers as implementing experts who lived in urban and rural areas. Table 2 provides information on participant descriptions.

Table 2.
Participants Descriptions

Participants	Environment		N
	Urban	Rural	
	Validator Team		
Lecturer (V1)	√		1
Lecturer (V2)		√	1
Teacher (V3)	√		1
Teacher (V4)		√	1
	Model Teacher		
Teacher	√		10
Teacher		√	26
	Students		
Grade Five	√		154
Grade Five		√	66
Grade Six	√		158
Grade Six		√	54

Instrument and Procedure

This research is the result of the final part of the implementation of VBI, namely real teaching in classrooms in elementary schools. Teachers watched and studied the videos about examples of inquiry-based learning scenarios independently before VBI implementation. Students got a pretest before learning and posttest after the learning

process. The learning process used learning tools in the form of a syllabus, lesson plans, inquiry-based student worksheets, and cognitive tests. Experts and teachers validate learning tools before they are used for teaching. The validator determines the suitability of 21 statements against the learning device, including the suitability of the content and construct. Validation test using Pearson product-moment correlation for validity and Cronbach-Alpha for Reliability. Table 3 provides information about the validity and reliability of learning devices. Table 3 shows the validation process with valid and reliable results. Pearson Correlation (r) on each validator> r_t = .433 indicates valid criteria. The validity test uses 21 statement items with a significance of 5%. Cronbach's Alpha value .759> .60, then the decision making in the reliability test by four validators was concluded to be reliable.

Table 3.
Validity and Reliability Statistics

Validator	Pearson Correlation (N=21)	Valid	Cronbach's Alpha (N of Items=4)	Reliable
V1	.808	√	.759	√
V2	.816	√		
V3	.626	√		
V4	.627	√		

VBI integrated with TWG, and DL effectively supports science teachers to become professional science teachers. Inquiry learning becomes a preferred learning approach for professional science teachers to improve Elementary School Students' Achievements. Student learning outcomes after being taught by the professional teachers were categorized based on Bloom's taxonomy, including remembering, understanding, applying, analyzing, evaluating, and creating (Wicaksono, Madlazim & Wasis, 2017). Elementary school students' achievement was measured in this study in the form of remembering, understanding, applying, and analyzing skills. The score for each component is described in a single score to provide information. The quality of student achievement was expected to increase through VBI reinforced by professional teachers who had participated in the implementation of VBI. The Role of The Professional Science Teacher was presented in Figure 1.

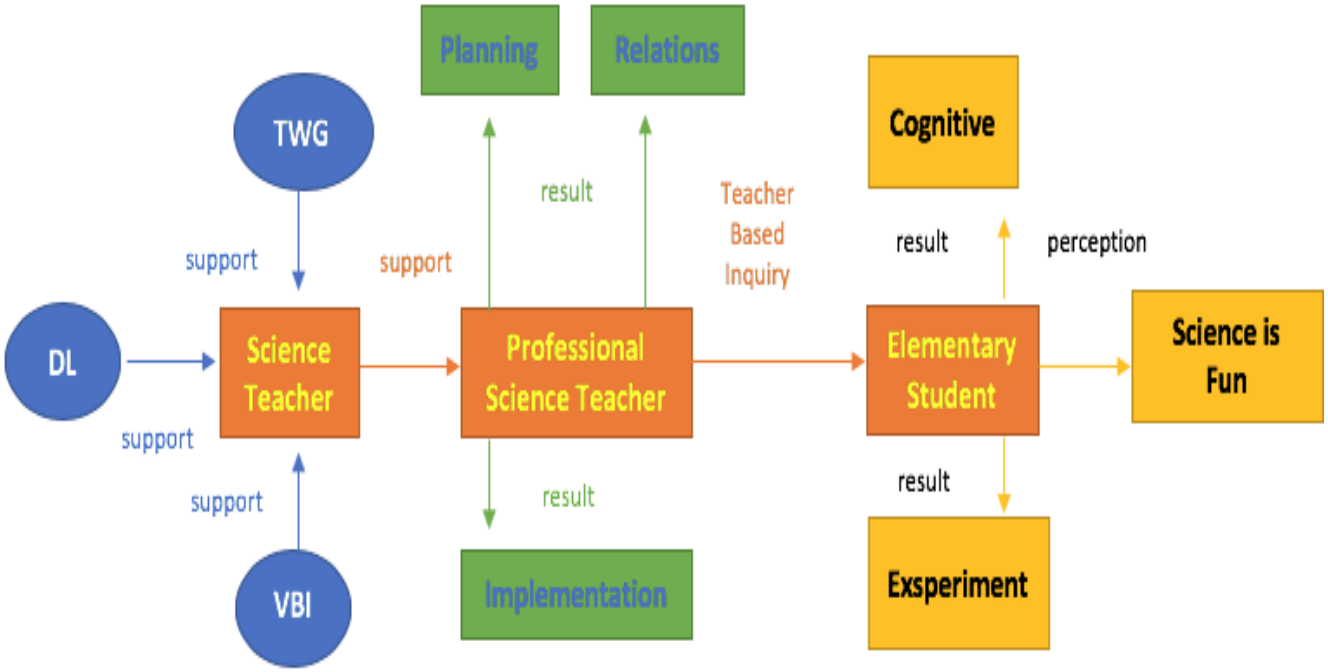

Figure 1.
Professional Science Teachers' Support toward Elementary School Students' Achievement

Data Analysis

Students' learning outcomes were analyzed based on the minimum mastery standard of elementary school based on the 2013 curriculum as follows: (1) very good: if 86 ≤ score ≤ 100; (2) good: if 76 ≤ scores <86; and (3) sufficient: if 65 ≤ scores <76. Improvement of teacher professionalism and student learning outcomes were determined based on n-gain, i.e. (posttest score - pretest score) / (100 - pretest score (Hake, 1998). The following criteria: (1) if n-gain ≥ 0.7 (high), (2) if 0.3 ≤ n-gain < 0.7 (moderate), and (3) if n-gain < 0.3 (low). The effect of the professional teacher

to improve student achievement was analyzed using the scores obtained in the pretest and posttest by using a Sign Test statistic whether the scores met the data normality or non-parametric. The statistical analysis software used in this study was IBM SPSS 22. The opinions of teachers who had participated in the tutorial were analyzed descriptively using the Guttman scale (Guttman, 1944). Student participation supports observation and interview data. The results are analyzed to show their interpretation of the influence of learning with a professional teacher.

Results and Discussion

The results of this study present the supporting data on the effectiveness of VBI on professional science teacher to improve elementary school students' achievements as a whole as follows: (1) pretest and posttest of students' achievements; (2) N-gain students' achievements; (3) statistical analysis of the effectiveness of VBI and students' learning process; and (4) teachers and students' response to the application of VBI on the learning process. Table 2 shows the n-gain value of each component of student achievements. N-gain values of student achievements components, remembering, understanding, applying, and analyzing, were consecutively in high, high, high, and moderate categories.

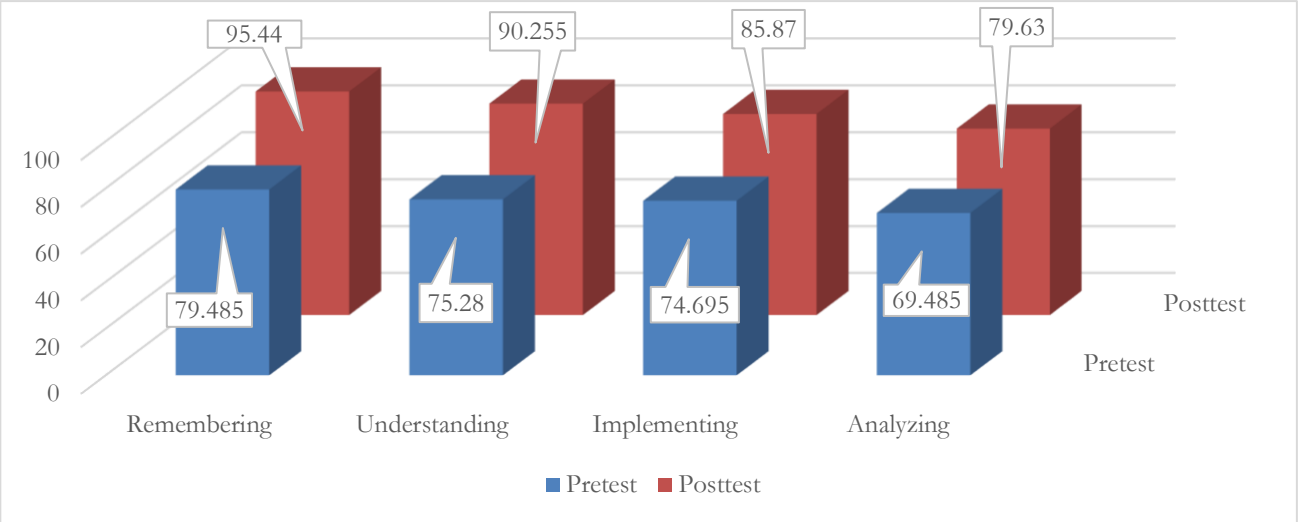

Figure 2.
The Average Scores of Pretest and Posttest in Students Achievements

Figure 2 and Table 4 visualize the average results of elementary school students' achievements before and after the learning process with the professional teacher who applied various teaching strategies as a routine in the two testing groups. Students' initial learning outcomes showed quite good. Figure 2 provides information on the average pretest and posttest results for all students. The students' average results showed a smaller trend in the analyzing component. The average results on the remembering component have met good learning outcomes.

Table 4.
The Average Scores of Pretest, Posttest, and Elementary School Students Achievements N-gain in Both Testing Groups

Group	Component	Pretest Average Score	Completeness	Posttest Average Score	Completeness	N-gain	N-gain Level
G1	Remembering	80.43	Good	95.50	Very good	.8	High
	Understanding	75.42	Adequate	90.30	Very good	.7	High
	Implementing	68.86	Adequate	86.99	Very good	.7	High
	Analyzing	59.21	Adequate	79.55	Good	.5	Moderate
G2	Remembering	78.54	Good	95.38	Very good	.8	High
	Understanding	70.13	Adequate	90.21	Very good	.7	High
	Implementing	68.96	Adequate	84.75	Good	.5	Moderate
	Analyzing	58.54	Adequate	79.71	Good	.5	Moderate

Statistical analysis of student achievements was presented in Table 5. The average results of learning by professional teachers affect student achievements in Table 5 showed very good results. Table 5 shows the findings of the statistic Sign Test for a non-parametric test. Each component of student achievements obtained 2-tail asymptotic significance for 0 values < .05. Some N shows positive differences. Table 5 produced the conclusion that the professional teacher has a significant influence on student achievements with a significance level of 5%.

Table 5.
Statistical Results from Sign Test on Student Achievements in Both Testing Groups

Group	Components		Differences			
			Negative	**Positive**	**Ties**	
G1	Remembering	312	0	312	0	< .05
	Understanding		0	312	0	< .05
	Implementing		0	312	0	< .05
	Analyzing		0	312	0	< .05
G2	Remembering	120	0	120	0	< .05
	Understanding		0	120	0	< .05
	Implementing		0	120	0	< .05
	Analyzing		0	120	0	< .05

Table 6 presents a statistical analysis of student achievements n-gain. Sign Test was used in the distribution of n-gain data on the topic of Electricity, Water, or other science topics based on non-parametric data. Table 6 concludes that there was no significant difference in the n-gain level of student achievements on two testing groups, with a 5% significance level in each component of student achievements.

Table 6.
Statistical Results from Sign Test on Student Achievements N-gain in Both Testing Topics

Group	Components		Differences			
			Negative	**Positive**	**Ties**	
Student	Remembering	432	0	4	428	> .05
	Understanding		0	4	428	> .05
	Implementing		0	2	430	> .05
	Analyzing		0	5	427	> .05

Teachers' responses to the VBI process were presented in Table 7. The professional teachers showed a positive response to the learning process that had been done. Teachers' responses were based on their professionalism, VBI implementation, and inquiry-based learning in general.

Table 7.
Response of Professional Teachers' to The VBI Implementation

Criteria	The Percentage of Professional Teachers who answered 'Yes' (%) Group		Average
	G1	G2	
Tutorial activities can help the teachers to improve their professionalism.			
Planning			
a. Determining learning improvement materials	97.22	100	98.61
b. Formulating learning improvement goals	83	79	81
c. Organizing materials and theme	98	93	95.50
d. Developing and organizing media	100	96	98
e. Planning to learn improvement scenarios	80	70	75
f. Designing management of learning improvement class	77	72	74.50
g. Planning procedures, types, and assessment learning improvement	100	100	100
Implementation			
a.Managing learning space and facilities	100	100	100
b. Carrying out learning improvement activities	100	100	100
c.Managing class interactions	94	90	92
d. Being open and flexible in helping students to develop their positive attitudes towards learning	100	96	98
e.Demonstrating special abilities in improving science subjects' learning process	74	80	77
f. Carrying out an assessment of the learning process and learning outcomes	100	100	100
g. Providing a general impression of implementing the	100	100	100

Criteria	The Percentage of Professional Teachers who answered 'Yes' (%) Group		Average
	G1	G2	
learning process			
Relation			
a. Establishing cooperation with government or regional institutions related to professionalism in education	100	100	100
b. Sharing experiences and providing mutual assistance and feedback in teacher working group meetings	100	100	100
c. Increasing knowledge, improving skills, and adopting a renewal approach in more professional learning through teacher working group deliberations	80	88	84
d. Empowering and assisting teacher working group members in carrying out learning tasks at school	80	90	85
e. Changing the work culture of teacher working group members by increasing knowledge, competence, and performance as well as developing teacher professionalism through professional development activities at the level of teacher working group discussions	90	96	93
f. Improving the quality of the educational and learning process reflected in the improvement of student learning outcomes	100	100	100
g. Improving teachers' competency through activities at the level of teacher working group deliberations	70	74	72
Tutorial activities can help teachers disseminate VBI.			
a.Analyzing video	100	100	100
b. Determining topics in the curriculum	90	100	95
c.Planning the lesson plan according to topic	94	88	91
d. Discussing the draft of the lesson plan in the teacher working groups	100	100	100
e. Conducting the simulation of the lesson plan draft in the form of peer teaching	97.22	100	98.61
f. Conducting reflection on peer teaching	90	96	93
g. Implementing in each class	100	100	100
Tutorial activities can help teachers describe inquiry-based learning in general.			
a. Observation	100	100	100
b. Asking and answering question	100	100	100
c. Searching information	97	95	96
d. Collecting data	100	100	100
e. Analyzing data	88	91.43	89.72
f. Communicating data	87	80	83.50
g. Constructing knowledge based on experience	87	96	91.50

Observation of the learning process and interviews were conducted on students to find out the implementation, student activities, and constraints on the application of the learning process with teachers who had taken the VBI tutorial. The results of the observation showed that most students seemed enthusiastic to carry out the learning process because contextual communication supports cognitive development. Most students expressed their happiness in the learning process. The following is an explanation of students' expressions, which indicates excellent results.

> *"I am pleased to learn science in this way. The teacher taught me about simple electrical experiments. I was interested in investigating. The teacher provided instruments and materials. The teacher helped us in experimenting. We worked in a group to assemble the instruments and materials used to carry out simple experiments. We were very happy to study simple electricity topics and to study other science topics if the teacher teaches science as this learning process".*

Students' active attitude in the learning process indicates that science is fun. However, there were still students whose learning outcomes were at a low level. Students were rarely invited to experiment in the science learning

process. Students seemed to have doubts in assembling simple electrical experiments even though it could be completed properly. The following is students' explanation in the completeness learning outcomes.

> *"I am happy with the way the teacher taught us. I fell I can play in class. I played simple electricity. I still find it difficult to explain simple electrical circuits. I still remember that there were electrical circuits that branch off and some were not branched or series".*

A small number of students looked noisy when the experiment was conducted in class. Students were silent when a group of friends conducted an investigation. The comment made by students who had not meet the completeness of learning outcomes was as follows.

> *"I am happy with this learning process. This learning is the first time for me to learn things in this way. I did not know what to do. I remember a little about electricity. I have trouble assembling my electrical circuit. The lights that I assembled did not turn on. I face a problem in calculating electricity".*

Discussion and Conclusion

This research generates new information through continuous teaching and learning treatments. The first treatment is the implementation of VBI, which is proven to be empirically effective against teacher professionalism (Budiastra et al. 2019b). In this context, the term professional teacher is used for teachers who have participated in a series of activities in the Teacher Working Group (TWG) forum in the form of learning using video-based teaching materials with the Video-Based Interaction (VBI) process. Teacher success can be achieved by demonstrating the implementation of professionalism in the aspects of planning, implementation, and relations to effectively improve student learning outcomes. Open University is a higher education institution in Indonesia that has a distance education program. In this study, the Open University developed tutorials in various urban and rural areas to improve the quality of teachers in their careers. The next threat is the implementation of teaching by professional teachers to improve student learning outcomes in their respective regions.

The pretest mean results showed the highest value on the remembering component. The average posttest result shows an increase in learning outcomes after students carry out the learning process in rural and urban areas. The manifestation of the teaching and learning process can occur in various models (Joyce, Weil & Calhoun, 2003). In this study, teachers used inquiry-based learning to teach their students. In a science perspective, inquiry-based learning involves students in scientific inquiry to fulfill students' curiosity (Burgh & Nichols, 2012). The inquiry model can overcome student learning constraints in both urban and rural environments. The characteristic of the inquiry model is that it raises the phenomenon. Engagement to phenomena can be explored through videos, images, and experiment kits in urban environments (Lämsä, Hämäläinen, Koskinen & Viiri, 2018). An urban environment may be considered to have better learning resource facilities than a rural setting. However, professional teachers can creatively change conducive learning in a rural environment (Chisango, Marongwe, Mtsi & Matyedi, 2020). Students can get involved with natural phenomena that occur in their environment. Simple ingredients and natural products can be a substitute for an experiment kit. Thus, the learning process can be created conducive both in urban and rural environments through inquiry-based learning.

The average pretest and posttest from remembering to analyzing tend to decrease. These results are following the cognitive level in Bloom's taxonomy (Zorluoglu & Güven, 2020). This study reviewed cognitive ability levels in the form of remembering, understanding, implementing, and analyzing. This cognitive level is determined based on the relevance of Piaget's theory to the level of primary school education. Elementary school students enter the stage of cognitive development between sensory-motor scenes to concrete operations (Akben, 2020). Remembering and understanding are cognitive abilities with low levels of thinking (Qasrawi & BeniAbdelrahman, 2020). Most students can master it, both students living in rural areas and students living in urban areas. Student learning outcomes show that students can easily remember the tools and materials needed for the water purification process. Students who live in rural areas as well as in urban areas are also able to remember the components of a simple electrical circuit even though the materials used are different. Students also easily understand how to purify water and simple electrical circuits. After the learning process, students can implement the topics that have been studied even though it is done in groups, and it takes a long time. At the cognitive analyzing level, some students began to experience difficulties (Kurniawan & Herman, 2020). Students should think further about why water is essential to purify. The analysis process encourages students to process information that comes from outside the classroom. The process is challenging if the students have not been involved in interpreting that when they have a stomachache, it can be because the water they drink is not clean. On the topic of electricity, some students have been able to understand that the reason the lights turn on is that there is an electric current in the circuit they have arranged.

The results of the students; fundamental knowledge showed their weak completeness. The initial ability of students was still below the national completeness standard. Student learning outcomes with professional teachers on remembering, understanding, applying, and analyzing in the two testing groups showed the same results. The quality of teachers influenced low students' learning achievement. The unprofessional teachers were influenced by teacher education, where elementary school teachers had not been fully equipped when they attend teacher education and the diploma/undergraduate level reinforced by their doubts about their teaching careers (Paquette & Laverick, 2017). This condition leads to the domination of lectures in science teaching in elementary school. Teachers were less able to activate students' thinking processes, and the lessons provided were not related to students' daily life. Attempts that had been done include improving the training of PowerPoint presentations to enhance the quality of teachers' teaching. Unfortunately, the shown results of the training were not as intended. Although the teachers were able to present PowerPoint, they did not have sufficient knowledge and skills to carry out scientific investigations (García-Carmona, Criado & Cruz-Guzmán, 2017). The teacher working group is an available source of information to increase teaching ability. However, the teacher did not participate in it. So far, the role of TWG is not optimal in preparing future teachers (Hoisington, 2018). Whereas in fact, facilities and program activities according to the curriculum can be activated for professional teacher training (Appleton, 2002).

The students' achievements in two testing groups were dominated with good results. The increasing student achievements were in high n-gain. Professional teachers can handle the class condition and teach science well (Soysal, 2018). Teaching science is a complex process based on students' initial knowledge and their experiences (Brown, Friedrichsen & Abell, 2013). After being involved in the VBI program, teachers were expected to plan and implement inquiry in teaching scientific concepts and phenomena. Students learn science through various familiar phenomena. Thus, there is a correlation between students' initial concept and the materials to be learned (Kleickmann et al. 2013). Elementary school students can receive guidance under their contexts. Then, they can develop their metacognitive ability with the given exercises (Alodat & Zumberg, 2018). Students face new conditions and relate the information learned with events or problems in their daily life (Aksakalli, 2018). Students engaged with the problem-solving activity through pictures and written responses. Pictures on the simple electrical circuit can attract students' interest. Written responses to the water purification process are relevant to students' daily life. Elementary school students' idea about the science concept illustrated with pictures and written responses allows a teacher to make better diagnostic and formative judgments (Strouse et al. 2018). The science learning outcomes of students in the G1 group had very good learning outcomes in the implementation component. G1 had a more advanced community environment. Thus, students have had adequate learning environment support since childhood. Relevant support showed that student achievements were influenced by regional economic and social development support (Smrečnik et al. 2014).

The results of this study support that teacher professionalism has a good effect on student achievement and learning (Tortop, 2014). Table 5 and Table 6 prove that students needed the motivation to stimulate their interest, ability, and habits in thinking (Erman, 2017). Students do not only think about the learning process. Learning requires students to form habits of mind (Maiese & Hanna, 2019). In line with Marzano's opinion regarding instructional engagement, habits of mind can be introduced, trained, developed, and strengthened to be better through learning models (Moye, 2019). The results of the observations show that most of the students look enthusiastic and happy to join inquiry-based learning. Some students who achieved good learning outcomes feel easy to understand and vary out of the inquiry. Piaget's cognitive development model states that students have different stages of development up to the high-level thinking stage (Marušić, Zorica & Pivac, 2012).

There is no difference in student learning outcomes on two topics about water and simple electrical circuits. Student learning outcomes with professional teachers showed an increase in the average posttest results. In essence, the learning process contains a series of actions by teachers and students based on reciprocal relationships that take place in educational situations to achieve specific goals (Engeness, 2020). This study prepares learning tools as preparation for the implementation and evaluation of learning systematically to achieve learning objectives. The learning device contains learning planning that prioritizes the integration of objectives/competencies, materials, learning activities, and evaluation (McNeill, Lizotte, Krajcik & Marx, 2006). The application of inquiry-based learning models in learning activities affects students' abilities constructively and leads to mastery of material on both topics. Student activity sheets also encourage student activity in remembering, understanding, applying, and analyzing. Student worksheets can also help provide instruction on what students should do (Cairns, 2019). Thus, learning tools that are systematic and relevant in the preparation, process, and competency objectives will have

consistent results on other topics. The implementation of inquiry that is in line with the tools not only successfully supports learning outcomes but also as a fun means of playing in studying for novice science students (Vartiainen & Kumpulainen, 2020).

The information says that were not fully mastered by students, such as designing management of learning improvement classes, demonstrating special abilities in improving science subjects, and increasing teachers' competency through activities at the level of teacher working group discussions. Teachers' response data were also supported by responses to the VBI process and inquiry-based learning in general. VBI was able to train teachers in teaching to support student learning achievement effectively. Student achievement can be different, based on school and teacher conditions (Shannag et al. 2013). The teachers' responses in Table 4 inform that the VBI tutorial activities in the TWG forum in the context of distance learning can help teachers improving their professional quality, describing VBI and broadening the knowledge of managing science teaching in elementary schools. Leading science teaching technology contributes to facilitating collaboration, discussion, and exchange of knowledge between students (peers), students with teachers, or teachers and students to achieve learning goals (Santosa, Degeng, Sulton & Kuswandi). Teachers' response to VBI implementation had led to improvements in the functioning of Indonesian TWG, where teachers' participation has been projected and limited to making evaluation instruments. VBI allows teachers not only to analyze videos independently but also to improve the unity of teacher working groups comprehensively. Nevertheless, more than 50% of teachers responded positively to the effectiveness of VBI in developing professional teachers.

The interview results showed that students felt happy joining the varied learning models. Students found it difficult to assemble inquiry-based experiments in class. From the results of interviews with students, it can be concluded that some students had not been able to explain the science concept descriptively (Erlina, Susantini & Wasis, 2018). Elementary school students' difficulties in explaining science concepts were because they were still at a very young age who had minimal verbal abilities in gathering information (Gnidovec & Torkar, 2019). The difficulties can be overcome by having a learning environment and technology that fits the context for elementary school students. The utilization of technology for learning is not only done in both high schools and universities but also elementary schools (Hamid, Setyosari, Ulfa & Kuswandi, 2020). Relevant research showed that students taught by competent teachers consistently showed better educational outcomes (Brophy, 2001). Innovate strategies by professional teachers make science teaching more engaging, more fun, and more collaborative (Rogayan & Macanas, 2020).

The conclusion of this research showed that the learning process offered by professional science teachers contribute to students' learning achievement. VBI implementation was found effective in increasing professional teachers' competence in teaching science in elementary schools through TWG in the context of distance learning. Professional teachers brought a significant increase in student achievement test scores before and after the tutorial, as shown by the 2-tailed asymptotic significance for $p < .05$. Student achievement based on the minimum mastery standard was consistently very good on two testing topics. The learning model used by teachers placed students as the center of learning activities in the form of varied inquiry activities, which improved students' learning outcomes. Teachers who had taken the VBI tutorial could realize elementary school students' learning motivation. Thus, students considered science is fun and were able to form habits of mind, even though teachers need more preparation to implement inquiry-based learning models in the learning process.

Recommendations

This research needs to be refined in dissemination in several rural areas and urban areas with specific environmental characteristics so that it raises various backgrounds for further innovation. Suggestions for further research in this study is the need to emphasize the process of interaction in learning. The process of interaction is essential in the form of student relations with students, students with teachers, media, and technology-based learning. Lack of interaction processes can lead to potential misconceptions and perceptions in students.

Acknowledgments

The writers would like to thank the Government of the Republic of Indonesia, especially the Ministry of Finance and Universitas Terbuka Research Center, for the funds under the letter numbered 2814/UN31.2/DN/2016 to complete this study. The writers also would like to extend our gratitude to several elementary schools in Tabanan, Bali, and East Belitung, Bangka Belitung Islands, Indonesia, for the support in the implementation of VBI in the context of distance learning. At last, the writers also thank validators, who made this study can be carried out

correctly.

Biodata of the Authors

Dr. A. A. Ketut Budiastra, M. Ed., born in Banjar Tengah Kawan, Kerambitan Tabanan, Bali, March 24, 1964. He obtained a Bachelor's degree in Chemistry Education from IKIP Jakarta (1989), Masters in Science Education from College of Education, University of Houston, Texas, USA (1995), and a Doctor in Science Education from Universitas Pendidikan Indonesia (2007). Since 2017 until now he has been a Chair of FKIP Basic Education Department at the Universitas Terbuka, Indonesia. The author is also active as a proposal reviewer on PKM Program Dir. Belmawa Dikti and obtained a permit as a reviewer national (KAN) and in several international journals. **Affiliation:** Universitas Terbuka. **E-mail:** budiastra@ecampus.ut.ac.id. **Orcid No:** 0000-0001-5478-753X. **Phone:** (+62)81272709993. **SCOPUS ID:** 57212343424

Dr. Iwan Wicaksono, M. Pd., born in Banyuwangi, June 18, 1989. He obtained a Bachelor's degree in Physics Education from Universitas Jember (2012), Masters in Science Education from Universitas Negeri Surabaya (2014) and a Doctor in Science Education from Universitas Negeri Surabaya (2017). He has been a lecturer in Science Education Universitas Jember since 2016. He is also active in conducting research, writing learning books, publishing and as a reviewer several international journals. **Affiliation:** Universitas Jember. **E-mail:** iwanwicaksono.fkip@unej.ac.id **Orcid No:** 0000-0003-0717-1577 **Phone:** (+62)82336199019. **SCOPUS ID:** 57191155659

Dr. Nia Erlina, M. Pd., born in Banyuwangi, August 10, 1987. She obtained a Bachelor's degree in Physics Education from Universitas Jember (2010), Masters in Science Education from Universitas Negeri Surabaya (2015) and a Doctor in Science Education from Universitas Negeri Surabaya (2018). He has been a lecturer in Science Education at IAIN Jember since 2019. He is also active in conducting research, writing learning books, and publishing several international journals. **Affiliation:** Institut Agama Islam Negeri Jember **E-mail:** nia.erlina1@gmail.com **Orcid No:** 0000-0003-2199-5046 **Phone:** (+62)82264496864 **SCOPUS ID:** 57205091838

References

Akben, N. (2020). Effects of the problem-posing approach on students' problem solving skills and metacognitive awareness in science education. *Research in Science Education, 50*(3), 1143-1165.

Aksakalli, A. (2018). The effects of science teaching based on critical pedagogy principles on the classroom climate. *Science Education International, 29*(4), 250-260.

Alodat, A. M., & Zumberg, M. F. (2018). Standardizing the cognitive abilities screening test (cogat 7) for identifying gifted and talented children in kindergarten and elementary schools in Jordan. *Online Submission, 6*(2), 1-13.

Annan, S. T., Adarkwah, F., Abaka-Yawson, A., Sarpong, P. A., & Santiago, P. K. (2019). Assessment of the inquiry teaching method on academic achievements of students in Biology education at Mawuko Girls School, Ho, Ghana. *American Journal of Educational Research, 7*(3), 219-223.

Appleton, K. (2002). Science activities that work: Perceptions of primary school teachers. *Research in Science Education, 32*(3), 393-410.

Bae, B. (2012). Children and teachers as partners in communication: Focus on spacious and narrow interactional patterns. *International Journal of Early Childhood, 44*(1), 53-69.

Boonsue, W., Jansem, A., & Srinaowaratt, S. (2015). Interactional patterns in face-to-face and synchronous computer-mediated communication in problem-based learning contexts. *Journal of Language Teaching and Research, 6*(1), 99-110.

Brauer, H., & Wilde, M. (2018). Do science teachers distinguish between their own learning and the learning of their students? *Research in Science Education, 48*(1), 105-116.

Brophy, J. (2001). Teaching (Functional Practices series 1). *Geneva and Brussels: International Bureau of Education and the International Academic of Education.*

Brown, P., Friedrichsen, P., & Abell, S. (2013). The development of prospective secondary biology teachers PCK. *Journal of Science Teacher Education, 24*(1), 133-155.

Budiastra, A. K., Erlina, N., & Wicaksono, I. (2019a). The factors affecting teachers' readiness in developing science concept assessment through inquiry-based learning process in elementary schools. *Advances in Social Sciences Research Journal, 6*(9), 355-366.

Budiastra, A. K., Erlina, N., & Wicaksono, I. (2019b). Video-based interaction through teacher working group forum to increase elementary school teachers' professionalism. *New Educational Review, 57*(3), 187-199.

Burgh, G., & Nichols, K. (2012). The parallels between philosophical inquiry and scientific inquiry: Implications for science education. *Educational Philosophy and Theory, 44*(10), 1045-1059.

Cairns, D. (2019). Investigating the relationship between instructional practices and science achievement in an inquiry-based learning environment. *International Journal of science education, 41*(15), 2113-2135.

Chisango, G., Marongwe, N., Mtsi, N., & Matyedi, T. E. (2020). Teachers' perceptions of adopting information and communication technologies in teaching and learning at rural secondary schools in eastern cape, South Africa. *Africa Education Review, 17*(2), 1-19.

Davis III, R. J., Brestan-Knight, E., Gillis, J. M., & Travis, J. K. (2018). Improving parent-child relationships through the use of video technology. *Journal of Higher Education Outreach and Engagement (TEST), 22*(3), 161-181.

Debarger, A. H., Penuel, W. R., Moorthy, S., Beauvineau, Y., Kennedy, C. A., & Boscardin, C. K. (2017). Investigating purposeful science curriculum adaptation as a strategy to improve teaching and learning. *Science Education, 101*(1), 66-98.

Dieker, L. A., Lane, H. B., Allsopp, D. H., O'Brien, C., Butler, T. W., Kyger, M., . . . Fenty, N. S. (2009). Evaluating video models of evidence-based instructional practices to enhance teacher learning. *Teacher Education and Special Education, 32*(2), 180-196.

Dignath, C., Buettner, G., & Langfeldt, H.-P. (2008). How can primary school students learn self-regulated learning strategies most effectively?: A meta-analysis on self-regulation training programmes. *Educational Research Review, 3*(2), 101-129.

Dow, W. (2006). The need to change pedagogies in science and technology subjects: A European perspective. *International Journal of Technology and Design Education, 16*(3), 307-321.

Dragoş, V., & Mih, V. (2015). Scientific literacy in school. *Procedia-Social and Behavioral Sciences, 20*(9), 167-172.

Engeness, I. (2020). Teacher facilitating of group learning in science with digital technology and insights into students' agency in learning to learn. *Research in science & technological education, 38*(1), 42-62.

Erlina, N., Susantini, E., & Wasis. (2018). Common false of student's scientific reasoning in physics problems. *JPhCS, 1108*(1), 012016.

Erlina, N., Susantini, E., Wasis, W., & Pandiangan, P. (2018). The Effectiveness of evidence-based reasoning in inquiry-based physics teaching to increase students' scientific reasoning. *Journal of Baltic Science Education, 17*(6), 972-985.

Erman, E. (2017). Factors contributing to students' misconceptions in learning covalent bonds. *Journal of Research in Science Teaching, 54*(4), 520-537.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (1993). *How to design and evaluate research in education* (Vol. 7): McGraw-Hill New York.

García-Carmona, A., Criado, A. M., & Cruz-Guzmán, M. (2017). Primary pre-service teachers' skills in planning a guided scientific inquiry. *Research in Science Education, 47*(5), 989-1010.

Gnidovec, T., & Torkar, G. (2019). Primary school students' conceptions about owls, experiences with owls and their sources of information. *Journal of Baltic Science Education, 18*(2), 255-263.

Guttman, L. (1944). A basis for scaling qualitative data. *American sociological review, 9*(2), 139-150.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American journal of Physics, 66*(1), 64-74.

Hamid, A., Setyosari, P., Ulfa, S., & Kuswandi, D. (2020). The implementation of mobile seamless learning strategy in mastering students' concepts for elementary school. *Journal for the Education of Gifted Young Scientists, 7*(4), 967-982.

Harlen, W. (2013). *Assessment & Inquiry Based Science Education*. Triestly Italy: Global Network of Science Academies (IAP) Science Education Program (SEP).

Hinduan, A. (2001). The development of teaching and learning science at primary school and primary school teacher education: Final Report URGE Project. Loan IBRD.

Hoisington, C. (2018). Addressing common questions about 21st-century science teaching. *Science and Children, 56*(1), 10-13.

Holbrook, J., & Rannikmae, M. (2007). The nature of science education for enhancing scientific literacy. *International Journal of science education, 29*(11), 1347-1362.

Jatmiko, B., Prahani, B. K., Munasir, S., Wicaksono, I., Erlina, N., & Pandiangan, P. (2018). The comparison of OR-IPA teaching model and problem based learning model effectiveness to improve critical thinking skills of pre-service physics teachers. *Journal of Baltic Science Education, 17*(2), 300-319.

Joyce, B., Weil, M., & Calhoun, E. (2003). *Models of Teaching*. USA: Pearson Education.

Kaya, S., & Kablan, Z. (2013). Assessing the relationship between learning strategies and science achievement at the primary school level. *Journal of Baltic Science Education, 12*(4), 525-534

King, D., & Henderson, S. (2018). Context-based learning in the middle years: achieving resonance between the real-world field and environmental science concepts. *International Journal of science education, 40*(10), 1221-1238.

Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Besser, M., Krauss, S., & Baumert, J. (2013). Teachers' content knowledge and pedagogical content knowledge: The role of structural differences in teacher education. *Journal of teacher education, 64*(1), 90-106.

Kurniawan, A., & Herman, T. (2020). *Didactic Design Of Material Cubes and Beams Volume Elementary School Students Class V*. Paper presented at the International Conference on Elementary Education.

Lämsä, J., Hämäläinen, R., Koskinen, P., & Viiri, J. (2018). Visualising the temporal aspects of collaborative inquiry-based learning processes in technology-enhanced physics learning. *International Journal of science education, 40*(14), 1697-1717.

Laverick, D. M., & Paquette, K. R. (2017). Service learning through a literacy tutoring program *Service Learning as Pedagogy in Early Childhood Education* (pp. 151-168): Springer.

Levine, J. (2019). *Exceptions are the rule: An inquiry into methods in the social sciences*: Routledge.

Maiese, M., & Hanna, R. (2019). Conclusion: Cognitive Walls, Cognitive-Affective Revolution, and Real-World Utopias *The Mind-Body Politic* (pp. 297-312): Springer.

Marušić, M., Zorica, I. M., & Pivac, S. (2012). Influence of learning physics by reading and learning physics by doing on the shift in level of scientific reasoning. *Journal of Turkish Science Education, 9*(1), 146-161.

McDermott, L. C., Shaffer, P. S., & Constantinou, C. P. (2000). Preparing teachers to teach physics and physical science by inquiry. *Physics Education, 35*(6), 411-416.

McNeill, K. L., Lizotte, D. J., Krajcik, J., & Marx, R. W. (2006). Supporting students' construction of scientific explanations by fading scaffolds in instructional materials. *The Journal of the Learning Sciences, 15*(2), 153-191.

Moye, J. N. (2019). *Differentiated curriculum', learning differentiated curriculum design in higher education.* Bingley: Emerald Publishing Limited.

Ngaisah, F. N., Ramli, M., Nasri, N. F., & Halim, L. (2018). Science teachers' practical knowledge of inquiry-based learning. *Journal of Turkish Science Education, 15*(Special), 87-96.

Paquette, K. R., & Laverick, D. M. (2017). Enhancing preservice teachers' skillsets and professionalism through literacy tutoring experiences. *Reading Improvement, 54*(2), 56-66.

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational psychology review, 16*(4), 385-407.

Qadeer, A., Tahir, A., & Chishti, M. I. (2018). Beginning teachers' professional self-image: reconciliation between teachers and head teachers. *Journal of Educational Research, 21*(1), 1027-9776.

Qasrawi, R., & BeniAbdelrahman, A. (2020). The Higher and Lower-Order Thinking Skills (HOTS and LOTS) in Unlock English Textbooks (1st and 2nd Editions) Based on Bloom's Taxonomy: An Analysis Study. *International Online Journal of Education and Teaching, 7*(3), 744-758.

Rogayan, J., D. V.„ & Macanas, G. A. (2020). AGHAMIC Action Approach (A3): Its effects on the pupils' conceptual understanding on matter. *Journal for the Education of Gifted Young Scientists, 8*(1), 223-240.

Santosa, E. B., Degeng, İ., Sulton, S., & Kuswandi, D. The effects of mobile computer supported collaborative learning to improve problem solving and achievements. *Journal for the Education of Gifted Young Scientists, 8*(1), 325-342.

Shannag, Q. A., Tairab, H., Dodeen, H., & Abdel-Fattah, F. (2013). Linking teachers'quali ty and student achi evement in the kingdom of saudi Arabia and Singapore: the impact of teachers'background variables on student achievement. *Journal of Baltic Science Education, 12*(5), 652-665.

Slavin, R. E. (2019). *Educational psychology: Theory and practice 9 th ed.* New Jersey: Pearson Education Inc.

Smrečnik, I. D., Fošnarič, S., & Čagran, B. (2014). Environmental impact on learning outcomes in science education in slovenian primary schools through the analysis of material work conditions. *Journal of Baltic Science Education, 13*(4), 535-543.

Soysal, Y. (2018). A review of the assessment tools for the student-led cognitive outcomes/contributions in the sense of inquiry-based teaching. *İlköğretim Online, 17*(3), 1476-1495.

Strouse, G. A., Nyhout, A., & Ganea, P. A. (2018). The role of book features in young children's transfer of information from picture books to real-world contexts. *Frontiers in psychology, 9*(50), 33-89.

Szabó, J., & Révész, G. (2018). Eternal questions of gifted education from the aspect of university teachers. *Journal for the Education of Gifted Young Scientists, 6*(1), 43-67.

Tortop, H. S. (2014). Examining the effectiveness of the in-service training program for the education of the academically gifted students in Turkey: A case study. *Journal for the Education of Gifted Young Scientists, 2*(2), 67-86.

Valdmann, A., Holbrook, J., & Rannikmae, M. (2017). Determining the effectiveness of a design–based, continuous professional development programme for science teachers. *Journal of Baltic Science Education, 16*(4), 576-591.

Vartiainen, J., & Kumpulainen, K. (2020). Playing with science: manifestation of scientific play in early science inquiry. *European Early Childhood Education Research Journal, 28*(4), 490-503.

Weganofa, R., Pratiwi, N., Liskinasih, A., & Sulistyo, G. H. (2020). The effectiveness of pre-reading activities on gifted students: A case on low achievement students. *Journal for the Education of Gifted Young Scientists, 8*(1), 501-513.

Wicaksono, I., Madlazim, & Wasis. (2017). The effectiveness of virtual science teaching model (VS-TM) to improve student's scientific creativity and concept mastery on senior high school physics subject. *Journal of Baltic Science Education, 16*(4), 549-561.

Zorluoglu, S. L., & Güven, Ç. (2020). Analysis of 5th grade science learning outcomes and exam questions according to revised bloom taxonomy. *Journal of Educational Issues, 6*(1), 58-69.