Teachers and Students' Perspectives on the Use of STEM-Oriented Blogs With the Flipped Classroom Strategy to Improve Representation and Argumentation Skills: A Cross-Sectional Mixed Method

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Abstract: The objective of this research was to investigate the Science teachers' and students' perception toward STEM-Oriented Blogs with the flipped classroom strategy to improve students' representation and argumentation skills. The method used in this research is mixed methods with Sequential Explanatory Design. This research was conducted on 30 junior high school science teachers and involved 76 students of class VII junior high school. Data were obtained through questionnaires distributed online and interviews online via WhatsApp video calls, then analyzed using descriptive analysis. The result shows that teachers and students have a positive perception toward STEM-Oriented Blogs with the flipped classroom strategy. As 80% of teachers had not used blog as learning media; all of students needs learning media that can be accessed via *smartphones.* The current media learning has not completely train students' representation and argumentation skills and that's skills was in low category. Based on the result, it can be concluded that STEM-Oriented Blogs with the flipped classroom strategy is needed to improve students' representation and argumentation skills.

Keywords: Argumentation; Blog; Representation; STEM

Introduction

Technology and science are developing rapidly nowadays. It also impacts the world of education, especially in science learning. In science learning, almost all concepts are communicated using visualization tools such as 3-D models, diagrams, 2-D images, 3-D images, and animations (Lengkana, 2018). Visualization of science concepts can be provided using learning media. Learning media is an integral component of the learning system. It means that learning media must be connected to the learning process. Without learning media, the teaching and learning process cannot occur, and there are no excellent learning outcomes (Andriani, 2019). The use of instructional media significantly influences students' attention to learning the material being taught. Using learning media can make the learning process more focused, motivate students, and reduce

misunderstandings or misconceptions among students (Tiyas and Dibyosaputro, 2020). Currently, learning media development is very rapid; many teachers have made innovations so that learning is more interactive compared to the usual one. Various interactive learning media can be used, one of which is by using a web blog.

Blogs are very effective for school learning media (Sartono, 2016). Through blogs, teachers can provide material in the form of text, videos, animations, presentations, discussions, exams, and online learning on a blog page. In addition, learning media that utilize this blog make it easier for students because it can be accessed anytime and anywhere. Through the use of blogs in learning, it can provide a set of tools that can enrich knowledge to answer the challenges of the development of globalization (Weni and Isnani, 2018). Blogs that contain explanations of current concepts have indeed been widely developed, but STEM-oriented

learning blogs still need to be widely developed, even though the development of STEM-oriented learning media is effectively applied to students (Paramita et al., 2020). STEM-oriented learning can increase students' interest and activeness in the learning process, enable students to represent something they see, and make arguments based on facts and supporting theories so that students' representation and argumentation abilities develop well.

This representation ability is crucial for students and closely relates to communication skills and problem-solving. Someone needs representation in pictures, graphs, diagrams, or other forms of representation to communicate something (Suningsih and Istiani, 2021). In line with this, students also need to have argumentation skills to connect the facts learned with the knowledge applied in everyday life. In argumentation, there is support for statements, but there are doubts, disagreements, and showing evidence. Through structured argumentation, students can understand the material from various points of view based on existing scientific evidence (Roja et al., 2020). Therefore, building the ability to represent and argumentation in learning can be done by utilizing technology, namely STEM-oriented blogs. Development of a STEM-oriented climate change learning blog that applies primary content in daily activities can represent primary STEM content in situations they face or find in life so that it can improve students' abilities, especially in representation and argumentation skills.

This research describes the perceptions of science teachers and students regarding science learning using STEM-Oriented Blogs with the flipped classroom strategy to improve students' representation and argumentation skills. These findings also provide a glimpse into the complexity of pedagogical work, which can inform the professional development of teachers to develop learning media as their teaching materials preparation.

Method

This study used a mixed method *(cross-sectional mixed method)* using a *Sequential Explanatory Design strategy.* The research was conducted on 30 junior high school science teachers and involved 76 students of class VII junior high school. Data collection was carried out using a questionnaire made via Google form and distributed online to find out the perceptions of teachers and students regarding the learning media used during the learning process. Data was obtained by online interviews using WhatsApp video calls to 4 teachers with qualifications two people are Masters graduates, and two people are S1 graduates (Figure 1).
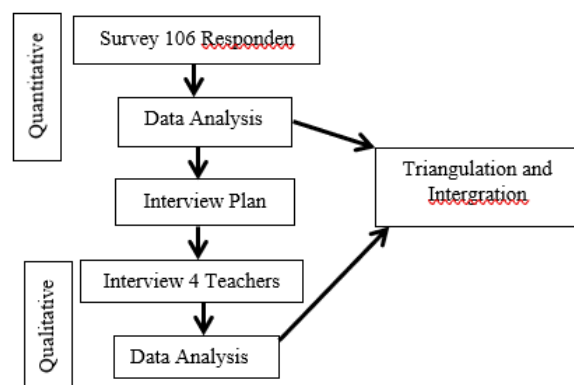

Figure 1. Data Collection Procedure

The characteristics of the respondents who filled out this questionnaire are presented in Table 1.

Table 1. Characteristics of Teachers and Students Who Fill in the Questionnaire

Teacher variable		Percentage (%)	n
Gender	Man	20	6
	Woman	80	24
Age	<25 years	0	0
	25-35 years	37	11
	>35 years	63	19
Long teaching	<5 years	10	3
	6-10 years	40	12
	> 10 years	50	15
last education	S1	66.7	20
	S2	33.3	10
Student variable		Percentage (%)	n
Gender	Man	39	30
	Woman	61	46
Age	12 years old	15	9
	13 years old	75	62
	14 years	10	5

The distributed questionnaire had five indicators: the use of learning media, the STEM approach, learning blogs, the flipped classroom strategy, and the ability to represent and argue. Research data obtained from teacher and student questionnaires were analyzed by grouping answers based on questionnaire questions, giving a score to each answer according to the scoring criteria, calculating the total score of the answers to each question. The completed questionnaire was analyzed based on the results of the questionnaire analyzing the needs of students, which were described in percentage form, then interpreted qualitatively.

Result and Discussion

The student questionnaire was filled out 76 students of class VII yunior high school in Lampung Province. The results of the questionnaire by students are presented in Table 2.

Table 2. Interpretation of Student Questionnaire Results

Indicator	Statement	Answer Percentage (%)	
		Yes	No
Use of learning media	Learning using learning media	83	17
	Students' understanding of the use of learning media	76	24
	STEM-oriented learning media improves representation and argumentation abilities	97	3
STEM approach	STEM-oriented climate change topic learning	63	37
Use of learning blogs	Classroom learning uses learning blogs	0	100
	The use of learning blogs helps students independently	97	3
Flipped classroom strategy	*Flipped classroom* strategy implementation	42	58
	Giving material before learning in class	69	31
	The need for learning media that can be accessed via *smartphones*	100	0
Representative and argumentative skills	The use of learning media improves the ability to represent and argumentation	97	3

The teacher questionnaire was filled out by 30 science teachers with different educational backgrounds and teaching years. The results of the questionnaire by teachers are presented in Table 3. Table 2 and Table 3 show that science learning already uses learning media but is still limited to pictures and videos. Science learning in class has never used learning blogs, especially STEM-oriented learning blogs. Learning on the topic of climate change has yet to use STEM-oriented learning media. Using learning blogs can help them study independently at home. The research results show that 85% of science learning in class uses instructional media used by teachers to attract students' interest and attention to ongoing learning. Through learning media, teachers can distribute, deliver, and connect learning resources to achieve learning objectives. Learning media is an integral component of the learning system. Therefore, learning media must be connected to the learning process. Without learning media, the learning process teaches that No can happen maximally and No results can be obtained from good study (Andriani, 2019). The use of instructional media significantly influences students' attention to learning the material being taught. Through the use of learning, media can create a learning process directed, motivating participants to education and reducing misunderstandings or misconceptions about participant education (Tiyas and Dibyosaputro, 2020).

Based on the study results, 80% of learners on climate change had never used web blog learning media, and another 20% used existing blogs on the internet such as teacher's rooms, Wikipedia, and other blogs. The use of blogs on the internet cannot facilitate learning according to the learning plan made by the teacher because blogs on the internet are usually created to provide information, not as learning media. Therefore, the development of blogs as learning media is needed to support classroom learning, especially on climate change.

Most teachers already use media, but the media used during learning is limited to power points and videos. One of the teachers said in the interview that: "The learning that I do always uses media because, through this learning media, it can interest students in the material to be studied".

As many as 75% of students know the media used during learning, such as power points and videos displayed by teachers using projectors in front of the class. This is supported by the results of interviews that: "On the topic of climate change, I usually use videos that show how climate change can happen. Usually, and I take videos from YouTube".

The use of power points and videos displayed by teachers attracts students' attention to learning, but not all material is suitable for presentation with power points and videos, so teachers need other media, such as blogs, to be able to present material. Teachers can maximally utilize the existence of blogs at this time as an alternative medium for conveying knowledge, online learning media, as well as solutions to students' thinking skills problems because by utilizing blogs, students are required to be able to represent what they see on the blog page and manage it to be useful information in learning (Arifin et al., 2010).

Table 3. Interpretation of Teacher Questionnaire Results

Statement	Answer		Information
	Choice	Answer Percentage (%)	
Science learning in schools uses learning media	Yes	55	
	No	15	
	Sometimes	30	
The media used in learning	Package book	20	
	Relevant pictures	25	
	Powerpoint	50	
	Online media	5	
If using online media, what online media is known	Online news sites (Cnnindonesia.com, Kompas.com, Detik.com)	10	
	Social media sites (Instagram, youtube)	65	
	Learning websites (teacher's room, educhannel)	20	
	Another learning blog website	5	
Sites that are known to obtain images/videos/animations related to the topic of climate change	None	0	
	Only one site	10	
	More than three sites	90	
Learning the topic of climate change using the media	Picture	30	
	Animated videos	15	
	Powerpoint	45	
	Weblogs	10	
Learning the topic of climate change using a learning media web blog. Write down the website used:	Never	80	Teacher's room
	Once	20	Wikipedia
			Forget
When using a web blog as a learning medium, what is the role of students	Opens the shared link	10	
	Do a scan on the QR Code	0	
	Search for the necessary web on his/her own	90	
Characteristics of web blogs that are commonly used	Displays complete material	15	
	Display material and pictures	55	
	Display material, pictures, and videos	20	
	Display material, pictures, videos, and practice questions	10	
Learning the topic of climate change in class	Material presentation	10	
	Presentation of material with pictures	75	
	Presentation of materials, pictures, and videos	10	
	Presentation of the material, pictures, videos, and practice questions	5	
Studying the topic of climate change uses learning strategies. Write down the learning strategy used:	Never	40	Inquiry
	Once	60	PBL
			Discovery
			Scientific
Studying the topic of climate change measures students' representation and argumentation abilities.	Yes	55	
	No	45	

Blogs have been widely developed, but STEM-oriented blogs have yet to be widely developed and used in learning. One of the teachers said in the interview that:

"I have never used a learning blog because it is hard to find a suitable blog. Especially now that there are lots of

advertisements on blogs on the internet that are inappropriate for students to see"

As many as 97% of participant's students agree that STEM-oriented learning media can improve students' representation and argumentation abilities, STEM-oriented learning can increase students' interest and activeness in the learning process, enable students to represent something they see and make arguments that are by the facts and supporting theories so that understanding concepts received by students become intact. Representational competence is a skill and practice that enables a person to reflectively use various representations or visualizations, individually and together, to think about, communicate, and act on biological phenomena regarding the underlying perceptual, physical entities, and processes (Kozma, 2005). Learners learn more effectively when they process information in various ways (Abdurrahman et al., 2011).

Blogs can provide a tool that can enrich knowledge to answer the challenges of globalization (Weni & Isnani, 2016). Through blogs or weblogs used in learning, students can access learning information, improve their technology skills, and share and reuse learning content (Lestari, 2020). Irmayanti and Nugroho (2016) states that possible alternative media used in pack material or content learning become more interesting is a learning medium wrong internet based One application is a media in the form of a blog. Utilizing blog media can increase a teacher's quality of self and competence (Saputro and Pardiman, 2012). By utilizing blogs as learning media, teachers have given an atmosphere of different learning _ for their teaching participants. The clear presence means of multimedia blogs enough to color the educational process in the classroom (Sulasmianti, 2018).

One of topic in Science lessons that need to be presented oriented to STEM is climate change. However, based on research results, as many as 63% of students stated that learning on climate change had yet to be presented oriented to the STEM approach, and all students stated that learning in class did not use learning blogs. Many teachers have carried out learning innovations, such as using science learning models based on learning problems, inventions, and others (Pratiwi et al., 2017). However, the use of STEM-oriented learning media blogs has yet to be widely implemented. Blogs can be used as a learning medium because blogs can be used for communication, as learning resources where teachers can post explanations and tips or examples that can be applied, as a collaborative tool, and as a vehicle for displaying student projects (Fajriah et al., 2017). Besides that, at the time of the interview the teacher said: "If the teacher provides subject matter through blogs, it can provide new experiences and make

it easier for us to learn because usually, we look for blogs ourselves to get the information we need".

Utilization of learning blogs provides opportunities for students to study independently before learning in class because 97% of students state that using learning blogs helps students independently. The use of STEM-oriented learning media requires an appropriate delivery strategy, an alternative STEM-oriented learning blog delivery strategy using the *flipped classroom strategy.*

STEM education can improve students' ability to solve problems, become innovators, be independent, and be able to relate what is learned to daily activities. Learning with STEM is an integration of learning science, technology, engineering, and suggested math could help success in the 21st century (Beers, 2011). The 21st century demands students to develop Skills in thinking (Pertiwi et al., 2017). Learning with the STEM learning approach can make students interested and get memorable learning experiences so as to generate motivation and interest in learning so that student learning outcomes can increase through the students' representation and argumentation skills. Development of learning media effectively STEM oriented applied to participant education (Paramita et al., 2020). Learning STEM-oriented can increase the interest And liveliness of participants educated in the learning process, create participant education can represent something they saw and make suitable arguments with facts and theory supporters so that understanding accepted concepts participant educate become whole. Understanding draft participant education will influence the quantity and quality of constructed arguments (Paramita et al., 2020).

Learning with applied *flipped classrooms* provide students with many opportunities to be more active and interactive in discussion activities in class (Susilawati & Khaira, 2021). In addition, through *the flipped classroom*, students can interact and argue more to solve the discussed problem or topic. However, 58% of students said this *flipped classroom strategy* had never been applied during science learning. As teacher said: "On the topic of climate change, I usually use the Problem-Based Learning model; with this model, I present problems that can provoke students to think critically about why these problems cause environmental change".

The learning carried out by the teacher so far has used several models, but the model used has yet to facilitate students to study at home before learning in class. Through *flipped classrooms, the* teacher can utilize technology that provides supporting additions to material learning for participant learn who can easily access online via various social media platforms. Learning instructions that are usually given directly by teachers in the classroom change to directed learning and the explanation can be accessed by participants who

educate online outside or inside the class. Technology not only affects the relationship between teachers and students but also increases learning outcomes from the learning process itself (Abdurrahman et al., 2019).

Flipped classroom changes what should be done inside the classroom to be done outside the classroom. Students no longer listen to the teacher's explanation in class but have to understand the material explanation from the teacher before they carry out discussion activities in class (Ario & Asra, 2019). Learning by implementing *flipped classrooms* provides students with many opportunities to be more active and interactive in discussion activities in class (Susilawati & Khaira, 2021). In addition, through *the flipped classroom*, students can interact more and argue more to solve the discussed problem or topic.

In learning with *flipped classrooms,* students learn through interactive technology, like surfing the web blog at home, and prepare themselves for active learning in class. So that teachers can provide material reinforcement and students can work together to solve problems or discuss in class rather than just being silent and doing their assignments that may not be understood (Annuuru, 2017). Web blogs presented with the *flipped classroom strategy* are appropriate as learning media because their use is not limited by time and place. The web blog contains various needs of students, such as LKPD, learning videos, online quizzes, and others (Alfrado, 2018), so learning with *flipped classrooms* using web blog media can be a solution in teaching abstract material such as climate change material.

Learning about climate change needs to be correctly facilitated so that students can explore conceptual, procedural, and process knowledge which are dimensions of knowledge that students need to have in the 21st century.

The ability of representation and argumentation is an ability that students need to have in facing the challenges of the 21st century. Through good representation, students can present arguments appropriately too. The representational ability allows educators to simultaneously display science concepts through verbal, pictures, graphs, diagrams, tables, or mathematical equations (Abdurrahman et al., 2011). This argumentation ability needs to be possessed by students in order to connect the facts learned with the knowledge that is applied in everyday life. As teacher said: "In discussion activities, it is common to find some children who are not good at expressing their arguments. Because the child does not fully understand the material, by practicing this representation and argumentation ability, it is hoped that students will be able to represent material appropriately and put forward appropriate arguments".

In argumentation, there is support for statements, but there are doubts, disagreements, and showing evidence. Through structured argumentation, students can understand the material from various points of view based on existing scientific evidence (Roja et al., 2020). In arguing, much convincing evidence is needed because the more evidence is presented, the stronger the argument will be. To be able to strengthen arguments, one can use statistical data, facts, or actual concrete experiences (Hendrikus, 1991).

The research results show that the development of STEM-oriented blogs as learning media on climate change using *the flipped classroom strategy* is needed to support science learning. STEM integration in the blog is presented in the following Figure 2.
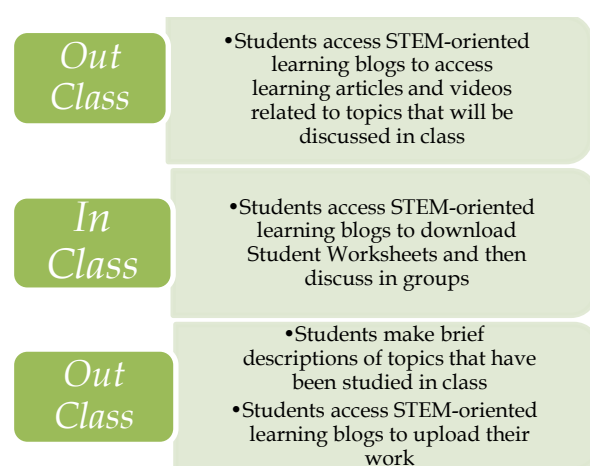

Figure 2. Learning activities with the flipped classroom strategy using STEM-oriented learning blogs

STEM-oriented learning blogs are designed in a structured manner based on the curriculum. They are presented in various forms of representation so that learning is more exciting and adds knowledge to additional skills for students. The flipped classroom strategy is one effective strategy for using STEM-oriented learning blogs. Teachers can maximally utilize the existence of blogs at this time as an alternative medium for conveying knowledge, online learning media, as well as solutions to students' thinking skills problems because by utilizing blogs, students are required to be able to represent what they see on the blog page and manage it to be helpful information in learning (Arifin et al., 2010).

Blogs are very effective for school learning media (Sartono, 2016). Through blogs, teachers can provide material in the form of text videos, animations, presentations, discussions, exams, and online learning on a blog page. In addition, learning media that utilize this blog make it easier for students because it can be accessed anytime and anywhere. Through the use of blogs in learning, it can provide a set of tools that can

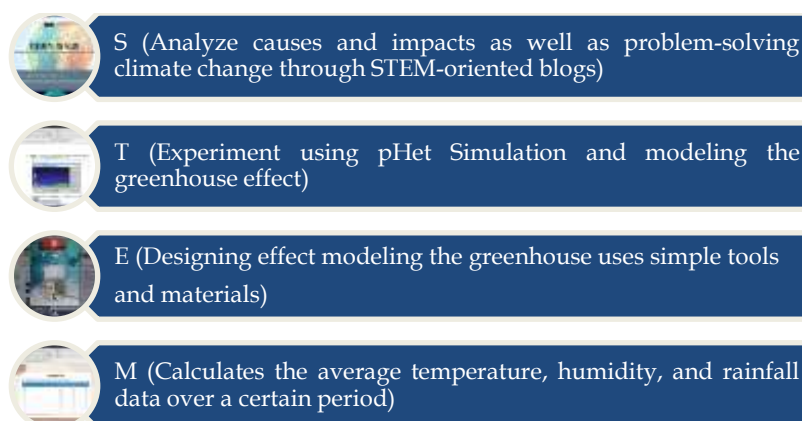enrich knowledge to answer the challenges of the development of globalization (Weni and Isnani, 2018).

S (Analyze causes and impacts as well as problem-solving climate change through STEM-oriented blogs)

T (Experiment using pHet Simulation and modeling the greenhouse effect)

E (Designing effect modeling the greenhouse uses simple tools and materials)

M (Calculates the average temperature, humidity, and rainfall data over a certain period)

Figure 3. STEM Oriented Design in Learning Blogs

Conclusion

Based on the research results, it is known that teachers and students have positive perceptions of STEM-oriented climate change learning blogs to improve students' representation and argumentation abilities. The study results show that most learning already utilizes media. However, the media teachers use during learning is limited to power points and videos, so students' representation and argumentation abilities still need to be trained. In addition, learning has yet to use the STEM approach with the *flipped classroom strategy*, so science learning using STEM-oriented climate change learning media blogs with the *flipped classroom strategy* can provide a better learning experience so that representation and argumentation skills can develop well.

Conflicts of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper.

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