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Online Instruction:
A Survey of High School Physics Teachers

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ABSTRACT
This paper aims to address the experience of physics teachers regarding the use of online instruction. Online surveys using Google form were adopted to obtain data for this study. A total of 67 science and physics teachers participated in this survey. Based on the findings, blended learning is more favorable compared to online instruction. In addition, the majority of teachers felt that technology used tend to bring instructional more demanding in terms of delivering sub-topics that contain mathematical equation and formulas. Other challenges are related to technological-based such network problems and pedagogical issues.

Keywords: *Survey, Online learning, Phyics teacher, Experience and perceptions.*

1. INTRODUCTION

The use of blended learning in the educational field has attractively increased with the rapid growth of ICT development [1, 2]. Through combining face-to-face and online instruction, might result in improvements in learning outcomes such as grades [3], concept comprehension [4], and generating knowledge [5]. Moreover, this teaching model might suit recent youth generations nowadays who are surrounded by technology devices. By engaging them in such an instruction atmosphere, the concept of blending those two models—traditional and online, might prepare them to face 21st-century challenges as future human resources [6]. According to [7], blended learning has received much attention in the last two decades by 4683 published papers featuring the referring term—blended learning. Similar to [8], which underlines e-learning as blending tools is the most cited publication with 50 citations. As the technology turns more sophisticated, so does the instructional development, this statement brings about what affordance online instructional can add to enhance learning both inside and outside the class.

As the access to technology has increased, so too has its use on the internet across Indonesia. By 2015, Indonesia had 88.1 million active users connected to the internet with a rise of fifteen percent over the year [9]. In 2018, Indonesia became the 4th top country before China, India, and the US [10]. Additionally, the number of internet users in Indonesia by 2019 stood at 167,38 and predicted will continue increasing with a slight rise to the year 2025 [11]. These data and also another term—industrial revolution 4.0, have affected teacher's views in Indonesia regarding suitable instructional models they should implement. Therefore, the learning system in Indonesia has improved digitally, adopting e-learning to classroom activity, for instance [12]. In 2014, researchers found that combining traditional and online learning could enhance students' self-management effectively [13-15]. This outcome might arise because students play as the key role in classroom activity; exploring information, generating knowledge, and designing problem solve while teachers stand as facilitators [16-19]. Additionally, [20-22] found that blended learning improves learners' skills in digital literacy. Furthermore, these advantages might support the students' preparation for facing 21st-century challenges.

In particular, science education, for instance, has improved through the blended learning paradigm [23]. As mentioned by [23] that implicating this model into class activity result in student's participation and satisfaction. Also, alternating some 'old' instructional tools to supplemental videos and problem solved-based assignment, contribute to increasing their engagement

and motivation in learning science that linearly results in better academic achievement. A study by [24] in 2012 performed research to access the influence of blended learning on students' comprehension and reasoning in the Physics concept. The apparent results reported that students achievement who was involved in the blended-set-class are better in terms of understanding and reasoning skills compared to the conventional group. Also, in 2018, [25] conducted a study for determining the effectiveness of guided inquiry-based on blended learning in high school physics instruction. The findings discovered that the developed product effectively increases students' skills in critical thinking. An additional benefit suggested by [26] that a well-designed blended classroom can affect learning outcomes and minimize the gender gap in physics education.

Regarding a well-designed blended classroom, teachers have a role in managing a suitable course as a blended instruction paradigm [27]. Despite the outlined benefits of blended learning, this model, under certain circumstances gives several challenges such as unrealistic expectations [28], student-perceived isolation [29], and lack of support for course redesign [30]. Moreover, through online settings, some contributing factors challenge the learning progress such as technology access, digital divide, and skill in technology usage [31]. Regarding these issues, [32] points out that blended learning cannot overtake the entire face-to-face activity with students. Similarly, with [33], learning activity remains to require teachers as supervisors both for blended or traditional to evaluate any difference regarding the achievement of these two groups. Therefore, assessing physics teachers regarding their practice during online learning and their perspective related to potential developed topics tend to go some way to providing additional literature for further strategy in designing instructional. In this context, our research aims to extend current knowledge regarding the practical benefits and drawbacks of online tools for delivering physics material according to the teacher's perspective. Moreover, this paper is a preliminary investigation to ascertain the need of adopting digital learning for high school physics subjects.

The rest of this paper is organized as follows. Section 2 outlines the methods. Section 3 presents the findings. Finally, section 4 draws the conclusion.

2. METHOD

2.1. Research Design, Settings, and Participants

This study of online learning used descriptive analysis relying extensively on a utilized survey instrument specifically for the research project. The apparatus was adapted as in [34] with some adjustments. This survey was conducted for science or physics high school teachers. A total of 67 physics teachers were recruited for this survey. Of these, sixty were undergraduate and seven were graduate level. The distribution of participants according to their place of teaching occurred as follows: junior high school (22), high school (39), vocational school (4), and primary/secondary school (2). Table 1 outlines the demographic information of the sample identity.

Table 1. Demographic profile of the respondents

Variable	Category	*N* (%)
Graduate status	Undergraduate Graduate	60 (89.55) 7 (10.45)
Place of school	Junior high school High school Vocational school Primary/Secondary	22 (32.84) 39 (58.21) 4 (5.97) 2 (2.99)
Teaching experience	0 – 5 years 5 – 10 years 10 – 15 years Over 15 years	29 (43.28) 9 (13.43) 16 (23.88) 13 (19.40)
Type	Civil servant (PNS) Non-civil servant	44 (65.67) 23 (34.33)

2.2. Instrument and Data Collection

This instrument was administrated via online Google Form. The arranged survey form, furthermore, was distributed to college alumnus and physics teacher association through Whatsapp groups. Questionnaire design began with multiple-choice questions for collecting data regarding participants' academic background, educational stages teaching scope, length of teaching experience, status—whether the teacher stands as permanent or temporary. In the second place, related to the context, the questionnaire asked tutors their preference in delivering instruction (face-to-face, online, or combination). This survey also asked participants regarding their student's perspectives whether they are in favor of online learning.

Next, the teachers were asked to collect information related to the learning platform or online apps that teachers utilized for conducting online instruction and evaluating purposes. Then, the instructors were questioned to indicate whether they must develop a digital application for instruction and assessment. Moreover, tutors were asked to determine what sub-topic in physics course that facing difficulty during its delivery through online learning. In the final stage of this survey, the questionnaire also asked their opinions regarding the causing factor to the existing obstacle. These questions were open-ended that allowed participants to explicitly express their belief in regards to the issue [35]. Furthermore, verbatim quotations from respondents' written comments were put forward for supporting the quantitative findings.

2.3.Data Analysis

Data were analyzed by utilizing Microsoft Excel for quantitative analysis. As stated in the introduction, our main objective was to discover the practical advantages and disadvantages of online learning in physics courses according to teachers' experience. By this, descriptive statistics such as frequency and percentage were calculated to summarize the data. Furthermore, the itemized results of open-ended questions aimed at describing key patterns and themes emerged from the responses.

3. RESULT AND DISCUSSION

3.1. Demographics

A total of 67 science and physics teachers were recruited for this study. Respondents included were high school tutors—junior and senior level, and vocational instructors. 22 participants described themselves as a science teacher in junior high school, 39 worked as physics instructors in senior high school, four worked in a vocational school, and two worked as a science teacher in primary/secondary school. Length of teaching experience in their fields covered a range from less than five years to over fifteen years. Sixty teachers were bachelor's degrees certified, and seven were master's degree in education. 44 participants worked under the public government as a civil servant, and 23 were non-governmental teachers.

3.2. Learning Environment Preference

Table 2a and Table 2b elucidate the information of delivery method preference according to teacher's and learners' perspectives. It is noticeable that 63 percent of teachers favored blended learning as a delivery method. Only 34 percent of those preferred the traditional approach.

Table 2a. Respons to teachers' preference in the delivery instruction

	n	%
Face-to-face	23	34,33
Online	2	2,99
Blended	42	62,69

In contrast to students, according to teacher's view, their students preferred traditional approach by 63 percent—as equal to the percentage of tutors who favored the blended classroom. It is obvious that only one-third of total students tend to learn in online-designed instruction. These data clearly reflect that there is a gap between instructors' and learners' preferences regarding the learning delivery method.

Table 2b. Respons to students' choice in learning environment according to teachers'view

	n	%
Face-to-face	42	62,69
Online	2	2,99
Blended	23	34,33

3.3. Learning Platform Preference

Participants shared a wide range of digital tools of what they utilized for conducting learning activity and assessing students' achievements. Regarding their responses to this question, the itemized answers were classified respectively as outlined in Table 3 and Table 4.

Table 3. Technology used for online learning

Technology	Platform	Frequency	%
Virtual learning	G-Classroom	34	17,89
	Moodle	4	2,11
	Padlet	1	0,53
	Phet	1	0,53
	Quizizz	2	1,05
	Quipper	4	2,11
	Edmodo	5	2,63
	Rumah Belajar	14	7,37
	Schoology	3	1,58
	Ruang Guru	4	2,11
	Zenius	1	0,53
	Kipin School	1	0,53
	Qualitiva	1	0,53
Social Network	WhatAapp	61	32,11
	Facebook	7	3,68
	Instagram	5	2,63
	Telegram	3	1,58
Video Conference	Zoom	7	3,68
	Cisco webex	1	0,53
Others	Youtube	25	13,16
	Others	6	3,16

Table 4. Technology used for assessing students' achievement

Technology	Platform	f	%
Virtual learning	G-Classroom	30	36,1
	Quiziz	18	21,7
	Examora	6	7,2
	Edmodo	2	2,4
	Qualitiva	2	2,4
	Kahoot	3	3,6
	Exam View	1	1,2
	Schoology	1	1,2
Social network	WhatsApp	13	15,7
	Messenger	1	1,2
	Facebook	1	1,2
Non-digital	Paper-based	6	7,2
Others	Google form	27	32,5
	Microsoft form	1	1,2
	Microsoft excel	1	1,2

The given table reveals that physics teachers tend to use social networking platforms such as WhatsApp as a digital tool for online instruction. In the second place, Google Classroom stood by 17,8 percent followed by Youtube with 13,16 percent. On the other hand, the learning process by virtual synchronous such as video conference is far less popular with only five percent compared to the other three instructional technology used.

For evaluating purposes, the majority of respondents preferred Google Services such as Google Classroom and Google Form which are the highest frequency used by 36 percent and 33 percent, severally. Quizizz is the third most popular followed by WhatsApp. Interestingly, during online learning, a small number of teachers remained used paper-based exams as evaluation media.

3.4. Needs in Instructional and Assessment Development for Instructor

The opinion of the participants about whether the instructors should develop instructional apps and digital-based assessments themselves were also elicited. The results of both findings are presented in Figure 1 and Figure 2, respectively.

Figure 1 illustrates that 60 respondents (ninety percent) agree that instructors should create their instructional design that suits online learning. Similar thought regarding digital evaluation, a majority of tutors believed that they should produce their assessment with technological equipment—as detailed in Figure 2.

Figure 1. Results for instructional development needs

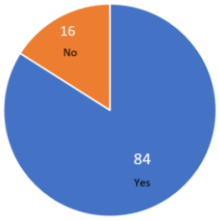

Figure 2. Results for assessment development needs

3.5. Scope of high school physics topic that facing difficulty during online learning

The findings regarding physics topics that tend become incovenient through online instructions are outlined in Table 5.

Table 5. Difficult particular topic of physics course to online delivered

Sub topic	frequency	%
Wave	13	20,31
Electricity	11	17,19
Optic	10	15,63
Dynamics	8	12,50
Work and energy	5	7,81
Fluids	3	4,69
Kinematics	2	3,13
Rigid Body Equilibrium	2	3,13
Impulse and momentum	2	3,13
Heat and temperature	2	3,13
Modern Physics	2	3,13
Magnetism	2	3,13
Nuclear Physics	1	1,56
Thermodynamics	1	1,56
Mathematical techniques	**6**	
Laboratory activity	**2**	

When asked about what material in physics courses tend to deliver inconveniently through online learning, seven participants respond negatively. Meanwhile, sixty subjects found difficulty in teaching particular subtopics.

As mentioned in the first section of this paper, blended learning offers several benefits for science education both for student and teacher, so do online instructional. Recent evidence highlight that implementing digital-based design into teaching progress could contribute to better learning outcomes such as concept comprehension [36], encourage collaborative learning [37], and bring positive influence to learners' attitude towards physics course [38]. Also, in terms of its usage, current studies mention online learning provides several advantages to science instructors, for instance, the feasibility to deliver learning content [39], experiencing laboratory activity virtually [40], and flexibility through provided multiple representations [41]. However, when teachers asked whether there is difficulty in teaching a particular topic of physics course during online learning, most of those surveyed indicated that teaching some syllabus digitally is more technically demanding. The most frequent topic tend to face obstacle according to the teacher's perspective is wave, followed by electricity and dynamics. It was also felt that content with equations became problematic for instructors. A sample of descriptions regarding this issue provided by the respondents follows:

> "It is difficult when teaching how to use the formula by using a mathematical approach.

> This is because the students in junior high school are lack of knowledge regarding symbols and how to use the formula when they answer the questions."

> "almost all formula-required material, I feel it is difficult to explain to my students"

Laboratory activities like experiments also stand as an obstacle during online learning. One teacher felt students should experience becoming a researcher in the laboratory. Another instructor found difficulty in assessing student's achievement when conducting the virtual experiment.

> "It is difficult to conduct experimental activity and assessing students' psychomotor skill"

> "Although some online platforms provide virtual laboratory, students remain need real experiment in a real laboratory for a deeper understanding concept."

3.6. Barrier and Issue

Findings from the respondents revealed that the network problem is the main cause of the material delivery issue. Due to the unstable connection, only several students attended online learning. Also, the location where the learners and instructors live causes uneven connection distribution. These connection problems, furthermore, lead to a communication obstacle between learners and teachers. Exemplary comments include:

> "Sometimes student less responsive to involve in online learning due to the network problem"

> "Network problem because most students live in a rural area where access to the internet is limited."

Another barrier for some participants was monitoring issues in learning engagement. Some respondents found that not all students were present when the class begin. Moreover, one tutor found a lot of unoriginal works as their answers to the given tasks. The followings are examples of written comments on this issue:

> "Students' are less monitored, some of them also doesn't have handphone.... Also, due to students' parent occupation who are farmers, they tend to help their parents rather than studying."

> "Students are less comprehensive to use the equation. By this, students tend to copy the answers to the given assignment from google. It can be seen that their answers are the same as the solved in the brainy website."

Related to "difficult particular topic", participants explained that those specific syllabi consist of numerous equations and required mathematical method to solve the problems. Furthermore, this leads to a lack of students' comprehension matter according to their perspective. Three respondents mentioned that learners were less motivated. This issue is apparent through their presence and the late collected assignment. One participant was explicitly justified that the online setting was less effective for delivering materials. Below are representative comments regarding this findings:

> "When providing a straight forward syllabus through video or learning application, not all my students understand. Another obstacle is, some students did not collect their duty."

> "...And the online learning platform seems less effective to deliver physics content."

Another issue was some of the teachers and students were lack of technical knowledge in using technology. Online learning was a new thing for several of them. In some instructors' opinions, organizing teaching administration through the provided learning digital platform was confusing. Below are the representative comments:

> "I don't fully understand the usage of online learning platforms or apps. Moreover, this method seems to make teacher and student are less communicative"

> "Some technical error that students face and the way how the material is comprehended by students when it's delivery through the online platform"

As proposed by [31], the evidence we found points to technological-related issues become the main factor of the difficulty in conducting learning activities. As indicated by [35], lack of knowledge and network connection problems result in obstacles to implementing digital setting into teaching in their course work. Also, equation and mathematical methods become a central issue regarding why instructors find the course was difficult to deliver.

4. CONCLUSION

This paper investigated the challenges of the online setting implementation in physics and science courses in the context of school education. Despite the acknowledged that digital learning offers a lot of advantages, findings indicate that online learning brings drawbacks in terms of material delivery and monitoring system. The tutor found some content in the physics syllabus contained with formula, symbol, and mathematical technique is inconveniently explained through the online learning platform. Moreover, they felt online learning seems less effective specifically to monitor student comprehension level and their participation.

The most important limitation lies in the small sample size. Nevertheless, this was intended to probe

and comprehend what online learning platform teachers prefer, what particular sub-topic in high school physics course that becomes demanding when taught through an online setting, and what barrier causes this obstacle, a much-neglected area in the literature. More broadly, research is also needed to determine students' perspectives to establish whether they are in favor of online instructional.

AUTHORS' CONTRIBUTIONS

Findings constitute an excellent initial step toward instructional development for a physics lesson. As the instructors suggested in this survey, the majority of them feel they should develop an instructional design and students' assessment themselves.

Furthermore, our study provides additional support for difficult particular sub-topic in physics courses through online learning. These results might be useful for practitioners as decision-makers in selecting or developing suitable instruction.

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