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Measurement-evaluation applications of context-based activities in hybrid learning environments

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Abstract: Students may be at a disadvantage when learning if they cannot follow lessons face to face due to such reasons as epidemics, disasters, transportation, or family. The main purpose of this study is to perform alternative measurement and evaluation practices in hybrid learning environments in a way that will make students in online physics lessons active participants in the process. The research uses the developmental, emancipatory, and critical action research models within the scope of the qualitative research method. The research was carried out over three weeks under the guidance of the researcher with 32 10th-graders at the school where the researcher taught physics for 12 years. Semi-structured interview forms, rubric forms, and documents were used as data collection tools. The interviews and documents were evaluated using content analysis, while the rubrics were evaluated using descriptive analysis. The students' active and decisive roles during the assessment and evaluation activities within the context-based learning activities regarding physics subjects as well as at the end of learning encouraged the students attending the lesson online and those attending in person to learn under the same conditions. In this context, activities in which students are a part of the learning and measurement-evaluation processes should be encouraged in online and hybrid-learning environments. Developing context-based activities with regard to experiments, analogy, and theoretical applications and developing qualified practices in which students will be active throughout the process under the guidance of action researchers will be beneficial for ensuring this.

1. INTRODUCTION

Alongside technology's presence having become felt intensely in all areas of social life in recent years, high-level studies have been carried out on the effective use of technological applications in health, education, economy, communication, defense, and transportation for increasing the quality of life (Fisher *et al*., 1996). With the COVID-19 pandemic having been the most important agenda item for all countries and societies of the world since 2019, important problems have emerged regarding teaching practices in educational environments during the pandemic (Tarkar, 2020). Economically developed countries have focused on technology-

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supported education by allocating high budgets to provide equal education practices without interruption to all individuals in their countries. In addition, these countries have ensured equal learning opportunities by including economically and socially disadvantaged student groups in their educational environments (Reuge *et al.,* 2021).

With the COVID-19 pandemic, face-to-face education was suspended for a long time in primary, secondary, and high schools in Türkiye and the world, and lessons started in alternative learning environments (Koçoglu & Tekdal, 2020). Teaching was provided in face-to-face and hybrid environments in accordance with course content. While educating in such new environments, new opportunities as well as problems emerged. Opportunities to apply these new experiences in teaching environments have emerged since the COVID-19 pandemic, one of which is the education and assessment-evaluation practices hybrid environments provide to students who are described as disadvantaged student groups and who have avoided face-to-face education in classes due to illness, the pandemic, or family reasons (Xie *et al*., 2020).

Hybrid education is defined as the situation of some students attending courses online while other students attend schools in-person. Hybrid education can advance verbal and visual communication by minimizing the communication distance between the instructor and the learner (Triyason *et al*., 2020). In hybrid learning, face-to-face or online monitoring of learning can be shaped according to the student's request, the teacher's planning, and the requirements of the environmental conditions (Potra *et al*., 2021). Some areas where student-centered and interactive applications are most needed in the hybrid teaching process within the scope of science are physics, chemistry, and biology courses. Due to the courses and subjects within the scope of science involving contents such as theories, experiments, observations, and applications, offering these courses simultaneously both face to face and to online students is very difficult. As a result, making qualified measurements and evaluations is also very difficult (Senel & Senel, 2021).

Society's needs and lifestyles have also started to change rapidly in parallel with the global technological developments. Accordingly, a need for change has emerged in the curricula, textbooks, and application activities of science courses that support technology in order to meet today's needs (Syafril *et al*., 2021). In this context, the physics curriculum and physics textbooks in Türkiye have been renewed, structured with context-based content, and updated in 2007, 2013, and 2018. The new curricula have been encouraged to present problems, concepts, and contexts of daily life effectively in the classroom environment, apply life-based assessment-evaluation practices throughout education, and give students active roles in all processes (Dicle Erdamar, 2019).

Teaching scientific knowledge in an interactive student-centered manner by associating it with life-based examples is called context-based learning, in which scientific concepts are associated and presented with meaningful events in students' lives (Hansman, 2001). Context-based learning can implement measurement and evaluation applications at every moment of the process. Using real-life scenarios while determining assessment-based problems encourages students to learn and results in them developing positive attitudes toward learning (Williams, 2008). In this sense, context-based problem-solving activities are the basic requirement of context-based learning. Since problems can involve more than one context, they should be prepared under the guidance of experts at a level that does not create misconceptions when determining their content (Yu *et al*., 2015). Context-based learning must include four stages in the learning outcomes; namely, (1) associating and integrating new concepts and information with the old information that has been learned, (2) creating the conceptual and theoretical infrastructure for the newly obtained information, (3) presenting the conceptually obtained and mentally modeled information by associating it with daily life problems, and (4) presenting the results in a report (Edelson *et al*., 1999).

Context-based measurements and evaluations structure information in depth and associate it with daily life problems in groups. While the teacher can prepare and present daily life scenarios, the students can also transform and present the previously learned information in scenarios using video and cinema (Avargil *et al.,* 2012) The transfer stage of learning prefers seeing student groups presenting videos and movies as daily life scenarios in the classroom environment through collaborations (Utami *et al*., 2016). Detective, action, military, and science fiction films are suggested as context tools that can be used for measurements and evaluations in context-based learning (Yu *et al*., 2015). The use of simulations as a tool for assessing subjects that can consume a lot of time abstractly, experimentally, or both makes students more interested in concepts and subjects. In addition, simulation scenarios help students learn abstract concepts in-depth and present their knowledge and skills more easily (De Jong & Van Joolingen, 1998).

Many studies are found in the literature on the effects of context-based teaching on learning, the positive-negative effects of hybrid learning, and student-centered measurement and evaluation practices in context-based learning. As a result of COVID-19, learning environments have moved out of the classroom all over the world, and online learning and hybrid learning environment (HLE) with active student participation have been developed through the effective and purposeful use of technology. One of the problems experienced in this process has been how to simultaneously perform a qualified evaluation of students (both online and in class) throughout the process (Makhachashvili, 2021). Context-based alternative measurement-evaluation practices are not found in the literature on online and HLEs.

Some problems have been encountered in the practice of HLE teaching, the most common of which are being able to simultaneously monitor the student groups participating in the lesson online and in class, accessing qualified materials that are able to attract the attention of both groups, keeping students' constant interest through measurement-evaluation activities in all learning processes, and designing learning environments in line with the teaching goals (Villegas-Ch *et al*., 2021). As a result of the effect of COVID-19 on students in all age groups, students who test positive for COVID-19 or who are suspected of having contracted the virus are not permitted to attend lessons in class for an extended time due to the quarantine conditions. Hybrid education applications appear as ideal environments for benefitting from teaching practices under the same conditions for students attending their courses in classroom environments (Benito *et al*., 2021). To eliminate the negative aspects of HLEs, emphasis should be placed on teaching that will attract the attention of high school student groups. In order to do this, technology-supported, student-centered, analogy-containing virtual laboratory applications and experiments that will enable students to develop positive attitudes toward science lessons should be used effectively (Dexter & Richardson, 2020). Considering that hybrid education applications will continue to increase after the Covid 19 epidemic, context-based measurement-evaluation applications are needed under the guidance of action researchers who personally face problems in learning environments and have researcher identities. Considering that the content of the lessons in hybrid education is provided with technology support to the student groups participating in the lessons online, teachers should use technological opportunities at an advanced level for educational purposes while teaching concepts, interacting with students, and making measurement-evaluation. In this context, this research study aims to develop alternative measurement-evaluation practices under the guidance of an action researcher in a way that will allow students attending online physics lessons in HLEs to be active participants in the process. In line with this purpose of the research, answers to the following questions are sought:

1. What student-centered measurement-evaluation methods exist in the context-based teaching process in HLEs, and how can they be applied in the relating stages?

2. Which student-centered measurement-evaluation methods can be applied during the stages of experiencing and applying in the context-based teaching process in HLEs, and how can they be applied?

3. Which student-centered measurement-evaluation methods can be applied in the relating stage of the context-based teaching process in HLEs, and how can they be applied?

4. What are students' views on the alternative measurement-evaluation methods used in context-based teaching in HLEs?

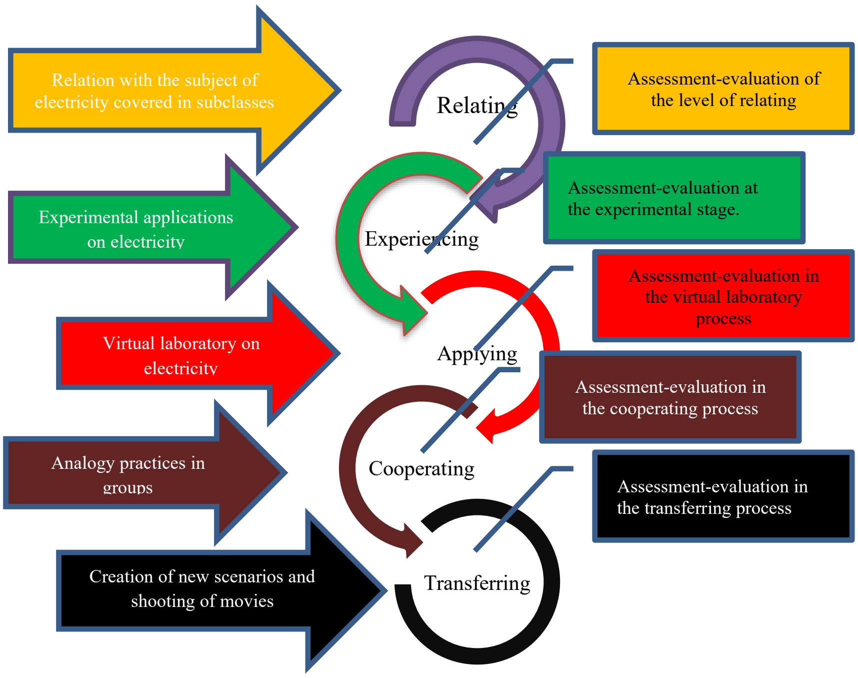
2. METHOD

2.1. General Background

This research uses the critical action research models within the scope of qualitative research. The main purpose of these models is to have students experience new knowledge, skills, and experiences under the guidance of the researcher and guide the development of the process in accordance with the learning objectives through the practitioner's and students' critical perspectives. Thus, the action researcher will see the deficient and clear aspects of their practices and have the opportunity to develop them. This approach aims to develop applications by considering students' readiness levels for theoretical studies in particular (Yıldırım & Şimşek, 2016). The study prefers a hybrid learning environment and action research because the researcher taught physics, whose curriculum in Türkiye is context-based, for 12 years at the school where the application was made, and some students had been attending classes online and others in class due to COVID-19. The process was additionally carried out in HLEs using the developmental, emancipatory, and critical action research models by applying alternative and student-centered measurement and evaluation practices at every stage to encourage students to participate actively in the whole process.

This research adapts the REACT teaching strategy, provides the teaching of, and applies the measurements-evaluations of the 10th-grade electricity subject in terms of a context-based approach. The REACT teaching strategy has been structured by considering the stages from Crawford's (2001) study. The implementation process is shown in Figure 1.

Figure 1. *The framework of context-based measurement-evaluation learning activity.*



During the relating phase, the students were shown the movie "The Current War" (Gomez-Rejon, 2017). Since science courses in Türkiye have a spiral structure, the subject of electricity had gradually been covered during the previous five years. In order to activate students' pre-knowledge, the request was made to note the factors affecting the brightness of lamp bulbs; the factors affected by resistance, voltage, and current; and the situations involving electricity being converted to heat, light, or sound on the worksheet. Peer evaluations were also requested by taking into account the grades each group member received. After discussing the concepts in the movie in groups, each group was given three minutes to make a presentation in order to compare the common decisions of all groups. Differences of opinion between groups were resolved with group discussions. In the experience phase, the teacher provided the student groups with a context-based scenario. Experimental applications and measurements were made under this scenario, and the students were asked to fill in the relevant figures and tables. Peer evaluations were made according to the ability of each person in the group to fulfill their role and responsibilities within the group. Peer group evaluations were carried out based on the groups' experimental practices. The experiencing phase lasted for one lesson. During the application phase, a text on conceptual change was handed out, and elimination of the students' misconceptions that could have arisen over the previous years was ensured. In addition, the students were asked to fill in the analogy map and then discuss it as groups. The application phase lasted for one class hour. During the collaboration phase, the student groups were asked to design and write a movie scenario that included concepts related to electricity. The students were asked to design in a virtual laboratory environment a model electrical system that they used at home in daily life. During the transfer stage, the groups were asked to implement the script they had written as a short 10-minute film. The stages of collaboration and transfer lasted a week (i.e., two course hours in total).

2.2. Sample

The research was conducted with 32 students studying at Mehmet Akif Ersoy Anatolian High School in the 2022 spring semester in Araklı, Trabzon, Türkiye. The applications on the 10th-grade students were maintained over three weeks for six-lesson hours. The school accepted students who had an average academic grade of 89 or higher in the 2021 fall semester. The students' academic achievement level at school was slightly above medium level. The researcher holding a master's and a doctorate in physics education had 12 years of experience in teaching physics at the school where the research was conducted. Interviews with students lasted between 17-23 minutes. The interviews were conducted with 12 male and 20 female students. As for the students' 2021 fall semester academic averages, seven students were between 50-70, 19 were between 70-85, and six were between 85-100. Also, 12 of the students were boarding students and 20 were day students.

2.3. Data Collection

For the research ethics permission, permit number 2022-10 dated March 8, 2022 with registration number E-54749836-050.99-71646 was obtained from the Usak University Rectorate of Science and Engineering Sciences Scientific Research and Publication Ethics Committee.

The research data were obtained using a semi-structured interview (SSI) form, the documents the students filled out during the process, and a structured observation form. One of the researcher's main goals was to obtain in-depth information from the students in the context-based activities in the HLE (Yin, 2009). During the evaluation of the measurement and evaluation practices within the scope of the action research, five interview questions were finalized to reflect the content of the research using the opinions of two academicians who are experts in their fields and of a psychological counselor guidance teacher. The third sub-goal of the research asked the students the following questions: What are your views on peer measurements and the peer group measurement practices in the teaching process? What are your views on the movie you watched at the beginning of the subject, on the scenario-based experiment, and on the simulation measurement? What are your opinions on the evaluation application? What are your opinions on the measurement of the activities where you wrote the script and shot short films? What are your opinions on the measurement applications regarding electricity?

Unstructured field study is a type of observation and was also used to arrive at the findings on how to apply measurement-evaluation methods for the first, second, and third sub-goals of the research. In unstructured observations, the researcher assumes the role of a participant observer (Yıldırım & Şimşek, 2016). The Mathematics and Science Classroom Observation Profile System (M-SCOPS) was developed by Stuessy et al. (2003); it was restructured within the scope of this research and turned into a draft form. With the observation form, the proficiency of the students at each stage was observed under five categories. Behaviors and practices were also noted that would support the research but were not found on the observation form. The SSI was used to compare the applications the teachers and students mentioned on the interview form and the applications within the scope of hybrid education.

For assessing the context-based activities in the hybrid learning process, the findings obtained from the peer and peer group measurements and evaluations of the students regarding all the processes as well as the teacher's findings obtained from the observation and document data of the students were evaluated with regard to their passing grades. The film, experiment, simulation, and new scenario stages were evaluated at 100 points each. Students noted their scientific knowledge and opinions about each stage on the worksheet. This paper was evaluated by the teacher within the scope of the document analysis. Observation findings were evaluated at a maximum of 100 points per stage. The students' evaluations of their peers and the peer group evaluations for the four stages were calculated at a maximum of 100 points each. The eight evaluations of the teacher and students for each student were collected, and the students' evaluation grades were obtained based on the total scores from the evaluations divided by 16.

2.4. Validity and Reliability

Achieving internal validity in action research is based on having the determined situations be consistent with reality and reflect the truth. In order to ensure the internal validity (credibility) of the research, one needs to explain the system of the evidence; provide diversity in the data, participant approval, and long-term interactions; and reveal the appropriate patterns and model (Yıldırım & Şimşek, 2016). External validity in qualitative research is based on being able to generalize the results obtained (Noble & Smith, 2015). In order to ensure validity and reliability within the scope of this research, data diversification was made through the interviews, the interview and document analyses, the presentation of the process for obtaining the research data alongside the evidence, and providing the participants' volunteer statements. Long-term interactions were additionally provided with the students as a result of the researcher having been a teacher at the boarding school as well as a physics teacher at the school for two years. Prior to the research, a broad literature study was conducted, and the developmental, emancipatory, and critical action research models were determined to be suitable to the nature of the research. In accordance with Miles and Huberman's (2015) agreement analysis formula for interview data (intercoder agreement = number of common opinions / [number of common opinions + number of different opinions]), the encoder similarity rate was calculated as 89% based on the results from the two expert examinations. This value shows the intercoder agreement to be high (Miles & Huberman, 1994). Interviews were conducted outside of class hours by informing the participants beforehand and obtaining the necessary permissions from them. During the interviews, the researcher did not interfere with the participants' views; also, probing questions were asked in places that went beyond the subject. Video recordings were taken with the permission of each participant.

2.5. Data Analysis

Content analysis was conducted using the appropriate themes, categories, and codes for the interview data. Content analysis involves comprehensively examining written statements that are similar in terms of meaning in order to ensure that readers and researchers can understand them in a way that creates integrity (Yıldırım & Şimşek, 2016). Codes with similar content are combined for ease of understanding. Descriptive analysis has been used to evaluate the observation findings. In descriptive analysis, direct statements are used to reflect the individuals' situations, views and the environment in which they are observed. The purpose of this type of analysis is to present the findings to the reader in an organized and interpreted form (Yıldırım & Şimşek, 2016). In this context, a four-stage descriptive analysis was adapted to the research, which involved deciding which template to follow, as well as the data processing and interpretation, and making sense of the data. While performing the descriptive analysis of the observation data, the scoring criteria of "No response/cannot be coded," "Alternative idea," and "Scientific idea" were used in the coding (Nassaji, 2015). Peer and peer-group evaluation forms were made based on Patri's (2002) study, with scores ranging from 1 to 5. While evaluating the scores of the students during the learning stages, the grading systems in their schools were taken as the basis. The scores in the student evaluation system were converted into a five-point system and an evaluation was made. Multiple linear regressions models were used to estimate beta coefficients and 95% confidence intervals. While interpreting the findings, students' opinions (direct quotations) were included to make the subject more understandable. The students have been encoded as S1, S2, …, S16 in order to preserve their anonymity.

3. FINDINGS

3.1. Findings Regarding Assessment-Evaluation in the Relating Stage

After watching the movie, which includes the concepts related to electricity, the students were asked to take notes in the relevant section of the worksheets, where which events and in which second of the movie the basic concepts related to electricity were used. Then, the students were asked to compare the answers within the group at the stage of group work. The data obtained from the students' evaluation of each other after the groups' common ideas were formed are shown in Table 1.

As seen in Table 1, in the relating phase, after watching the movie about electricity, the students evaluated their peers and received high scores in the themes of volunteering to work, sharing what they know, and working together. On the other hand, the students received low scores on such themes as duty responsibility and cooperation and also exhibited high-level behaviors in the codes of learning by taking notes with questions that developed their sense of curiosity by doing research voluntarily and interactively during the process of watching movies on the subject of electricity. The scores of the students who attended the course online and face to face are close to each other.

Table 1. *Peer measurement data at the relating stage.*

Theme	Category	Cods	*N*	$\overline{X}$
Participates in studies voluntarily	Face-to-face	Theoretical work, taking notes while watching the movie, interaction with the course content, curiosity	25	4.7
	Online		7	4.6
Shares what he knows with his friends	Face-to-face	Asking questions, interacting in intriguing places	25	4.5
	Online		7	4.5
Helps friends when needed	Face-to-face	Active role in the group, research when questioned	25	4.0
	Online		7	4.0
Gathers information from different sources	Face-to-face	Scientific resources, scientific content internet resources	25	4.4
	Online		7	4.2
Respects the opinions of his group mates	Face-to-face	Don't care even if they have different opinions, have the right to speak as much as necessary	25	4.3
	Online		7	4.4
Duty responsibility is at a high level	Face-to-face	Homogeneity in task sharing	25	3.9
	Online		7	4.1
Likes to work together	Face-to-face	Volunteering, Willingness for new knowledge	25	4.5
	Online		7	4.2
Contribution to the formation of the group idea	Face-to-face	Original ideas, contribution to group opinion	25	4.2
	Online		7	4.0
Total	Face-to-face		32	4.3
	Online			

After each student group wrote their common views on the worksheets, the groups made presentations and compared their views. The data obtained from the evaluations of the groups as a result of the presentations are shown in Table 2.

Table 2. *Peer group evaluation data in the relating phase.*

Theme	Category	Cods	*N*	$\overline{X}$
Presentation	Face-to-face	Time use, content, persuasion		4.3
	Online			
Accuracy of information	Face-to-face	Inclusivity, scientific		4.4
	Online			
Collaboration of group members	Face-to-face	Collaboration, research when questioned		4.6
	Online			
All group members fulfill individual responsibilities	Face-to-face	Involvement of the whole group, individual responsibility		3.7
	Online		6	
Interaction of group members	Face-to-face	Everyone has a say, everyone contributes		4.2
	Online			
Task sharing competence	Face-to-face	Homogeneity in task sharing		3.8
	Online			
Persuasion competence	Face-to-face	Scientific persuasion, collaborative persuasion		4.4
	Online			
Learning competence of group members	Face-to-face	Whole group learning, individual competence		4.7
	Online			
Total	Face-to-face		6	4.4
	Online			

As seen in Table 2, student groups scored high in learning competencies and group cooperation themes, and scored low in task sharing and fulfilling responsibilities. The findings obtained as a result of the document analysis regarding the process performances of the students in context-based activities in hybrid learning environments are shown in Table 3. As seen in Table 3, as a result of the document review, the students got advanced scores in electrical energy, brightness and current intensity, but low scores in potential difference.

Table 3. *Document review data on students' competencies in the process at the relating stage.*

Concepts	Events in the movie	N	$\overline{X}$
Electrical voltage	Burning of the lamps	32	3.2
Electrical current	Increasing or decreasing the brightness of the lamps		4.2
Resistance	Using lamps with different characteristics		4.0
Brightness	The increase in light intensity with the change of the characteristics of the generator and lamps		4.4
Electrical energy	Illumination of environments with light connected to electricity		4.1

3.2. Findings Regarding Measurement-Evaluation in Experiencing and Applying Stages

In the electrical circuit on the house presented as a model in the worksheet, the circuit elements were placed in series and parallel and the drawings were made in the figure. The data obtained from the students as a result of the document review are shown in Table 4.

Table 4. *Documentary findings on students' competencies in experiencing and applying stages.*

Concepts	Experiencing and Applying applications	f		$\overline{X}$	
		Experiment	Drawing	Experiment	Drawing
Electrical voltage	Parallel, serial	6	32	4.8	4.4
Current intensity	Association with voltage, branching, main branch			3.9	3.8
Resistance	Parallel, serial			4.0	4.3
Luminescence	Relationship with resistor, association with voltage			4.2	3.8
Electrical energy	Voltage, resistance, current intensity relationship			4.1	3.8

As can be seen in Table 4, in the experimental applications of experiencing and applying stages, electrical voltage and luminosity concepts received high scores. In the drawings, the electrical voltage and resistors exhibited high-level behaviors; scenario-based activities related to electricity were developed as well. By presenting the house model in the worksheet, the students were asked to demonstrate their electrical circuits experimentally by making use of the scenario. During the activity process, the students were evaluated by the teacher with a rubric form, and the data are shown in Table 5.

Table 5. *Evaluation of students with rubric form in experiencing and applying stages.*

Measurement	Factors	*N*	$\overline{X}$
Getting to know the tools	Ammeter, Voltmeter, Generator, Switch, Lamp	32	5.0
Associate concepts	Resistance, Ohm's law, R-i relationship		3.8
The experimental setup	Series circuits, Parallel circuits, Branching of current		4.4
Ability to operate	Electrical energy, current branching		4.6
Simulation setup	Series circuits, Parallel circuits, Branching of current		4.8
Ability to explain	To be able to explain Ohm's law, to associate theory with practice.		4.3

As can be seen in Table 5, students got high scores while creating simulation mechanisms during the experiencing and applying stages. In addition, the tools used in the experiments were successfully recognized by the students and the experimental setups could be operated successfully. In the category of associating concepts, it was revealed that they did not develop enough. In the Experiencing and Applying stages, after the groups' common ideas were formed, the students were asked to evaluate each other within the group. The data obtained from the students' evaluations of each other are shown in Table 6.

Table 6. *Evaluation of students with rubric form in experiencing and applying stages.*

Theme	Category	Cods	*N*	$\bar{x}$
Participates in studies voluntarily	Face-to-face	Theoretical work, taking notes while watching the movie, interaction with the course content, curiosity	26	4.6
	Online		5	4.6
Shares what he knows with his friends	Face-to-face	Asking questions, interacting in intriguing places	26	4.5
	Online		5	4.4
Helps friends when needed	Face-to-face	Active role in the group, research when questioned	26	4.1
	Online		5	4.1
Gathers information from different sources	Face-to-face	Scientific resources, scientific content internet resources	26	4.5
	Online		5	4.3
Respects the opinions of his group mates	Face-to-face	Don't care even if they have different opinions, have the right to speak as much as necessary	26	4.4
	Online		5	4.5
Duty responsibility is at a high level	Face-to-face	Homogeneity in task sharing	26	4.0
	Online		5	4.1
Likes to work together	Face-to-face	Volunteering, Willingness for new knowledge	26	4.3
	Online		5	4.2
Contribution to the formation of the group idea	Face-to-face	Original ideas, contribution to group opinion	26	4.2
	Online		5	4.2
Total	Face-to-face		26	4.3
	Online		5	4.3

As seen in Table 6, in the Experiencing and Applying stages, students evaluated their peers after experiment and simulation applications; they received high scores in the themes of voluntary participation in studies, sharing what they know, respecting the opinions of their groupmates, and collecting information from different sources. At this stage, the scores of students participating in the course online and face-to-face are close to each other.

3.3. Findings Regarding Measurement-Evaluation in Cooperation and Transferring Stages

The data obtained from the worksheet documents for analogy maps during the implementation process in the Cooperation and Transferring stages are shown in Table 7. As can be seen in Table 7, as a result of the evaluation of analogy map document data, individual student success was 65%, while group success was 96% as a result of the answers they created in interaction with each other. In the Cooperation and Transferring stages, the findings obtained with the help of the rubric form as a result of the groups developing film scenarios and shooting as short films are shown in Table 8.

Table 7. *Finding from the analogy map.*

Situations	Expected answers	*N*		*f*	
		Individual	Group	Individual	Group
Similar feature	Farmers	32	6	19	6
Compare	Comparable			28	6
Simulated feature 1	Electrical current			22	6
Simulated feature 2	Electrical voltage/Current			14	5
Total (%)				65	96

Table 8. *Scenario and short film evaluation findings of student groups.*

Concepts	Experiencing and applying applications	*N*		$\overline{X}$	
		Experiment	Drawing	Experiment	Drawing
Electrical voltage	Parallel, serial			5.0	5.0
Current intensity	Association with voltage, branching, main branch			4.9	4.9
Resistance	Parallel, serial	6	6	4.7	4.8
Luminescence	Relationship with resistor, association with voltage			5.0	5.0
Electrical energy	Voltage, resistance, current intensity relationship			5.0	4.8
Total		6	6	4.9	4.9

As it can be seen in Table 8, after the student groups structured the subjects and concepts related to electricity in-depth in the cooperation and transferring stages, they put forward applications by getting high scores as scenarios and films.

In the cooperation and transferring stages, after the groups' common ideas were formed, the students were asked to evaluate each other within the group. The data obtained from the students' evaluations of each other are shown in Table 9.

Table 9. *Peer evaluation data in cooperation and transferring stages.*

Theme	Category	Factors	*N*	$\overline{X}$
Participates in studies voluntarily	Face-to-face	Scenario creation stage, associating the scenario with electricity concepts, taking part in a short film	26	4.8
	Online		6	4.7
Shares what he knows with his friends	Face-to-face	Asking questions, interacting in intriguing places	26	4.7
	Online		6	4.7
Helps friends when needed	Face-to-face	Active role in the group, research when questioned	26	4.5
	Online		6	4.6
Gathers information from different sources	Face-to-face	Scientific resources, scientific content internet resources	26	4.7
	Online		6	4.9
Respects the opinions of his group mates	Face-to-face	Don't care even if they have different opinions, have the right to speak as much as necessary	26	4.5
	Online		6	4.5
Duty responsibility is at a high level	Face-to-face	Homogeneity in task sharing	26	4.6
	Online		6	4.7
likes to work together	Face-to-face	Volunteering, Willingness for new knowledge	26	4.8
	Online		6	4.7
Contribution to the formation of the group idea	Face-to-face	Original ideas, contribution to group opinion	26	4.5
	Online		6	4.6
Total	Face-to-face		26	4.8
	Online		6	4.7

As seen in Table 9, students exhibited high-level behaviors in all categories in cooperation and transferring stages. The peer measurement scores of the students who attended the course online and face-to-face are close to each other.

After each student group wrote their common views on the worksheets, the groups made presentations and compared their views. The data obtained from the evaluations of the groups after the presentations are shown in Table 10.

Table 10. *Peer group evaluation data at the cooperation and transferring stage.*

Theme	Category	Cods	Groups (*N*)	$\overline{x}$
Presentation	Face-to-face Online	Time use, content, persuasion	6	4.8
Accuracy of information	Face-to-face Online	Inclusivity, scientific		4.9
Collaboration of group members	Face-to-face Online	Collaboration, research when questioned		4.8
All group members fulfil individual responsibilities	Face-to-face Online	Involvement of the whole group, individual responsibility		4.7
Interaction of group members	Face-to-face Online	Everyone has a say, everyone contributes		4.7
Task sharing competence	Face-to-face Online	Homogeneity in task sharing		4.8
Persuasion competence	Face-to-face Online	Scientific persuasion, collaborative persuasion		4.6
Learning competence of group members	Face-to-face Online	Whole group learning, individual competence		4.7
Total	Face-to-face Online		6	4.8

As seen in Table 10, student groups achieved high scores by exhibiting high-level behaviors in all categories in Cooperation and Transferring stages.

3.4. Student Views on Measurement-Evaluation Methods in Context-Based Teaching Process in Hybrid Learning Environments

In the context-based teaching process in the hybrid learning environment, the students' views on measurement and evaluation as a result of the teaching practices based on the REACT strategy are shown in Table 11.

In Table 11, when students' views on measurement-evaluation methods in context-based teaching processes in hybrid learning environments are examined, it is seen that there is an intensity in the positive theme. It is seen that the opinions of peer and peer group evaluations cause students to work harder and increase their motivation and success in cooperation. The use of analogy maps as a measurement-evaluation tool comes to the fore in the theme of positivity, which contributes to the structuring of students' knowledge permanently and entertainingly in interaction, and as negativity, it is complicated because it is a new situation.

Table 11. *Student opinions on measurement and evaluation in context-based teaching.*

Theme	Category	Cods	*f*
Positive	Peer evaluation	Objectivity	23
		Motivation	21
		Hard work	20
		Following closely	19
		Success	19
	Peer group evaluation	Success	18
		In-depth learning	12
		Attitude	10
		Research	10
		Equality	9
	Document analysis	Detailed information	13
		Evaluation by grade	12
		Learning all information	11
	Analogy map	Fun	14
		Permanent information	10
		Interaction	10
	Rubric form	Continuous motivation	13
		Keeping up with the lesson	12
		Interacting with the teacher	9
Negative	Peer evaluation	Close friend	23
		Inability to follow	15
		Privacy	11
		Duration	9
	Peer group evaluation	Impartiality	17
		Grade	11
		Duration	10
	Document analysis	Duration	14
		Cooperation	12
	Analogy map	First time event	13
		Complicated	10
	Rubric form	Inability to distinguish	12

As a result of the use of rubric forms as an alternative measurement-evaluation tool in the in-class interaction process in science, it is revealed that students provide long-term interaction and continuous motivation towards the lesson. Some of the students' views on measurement-evaluation methods in the context-based teaching process in hybrid learning environments are as follows:

> *S11: "We had some emotional difficulties in peer measurement in the first activities, we made more qualified measurements in the following activities, taking into account the measurement criteria set by our teacher. Thanks to the peer and peer group evaluation, we felt the obligation to work continuously and efficiently both individually and in the group. This has led to an increase in our individual and group success."*

> *S5: "Watching a movie at the beginning of the lesson both relaxed and motivated us and made us more interested in the subject. The movie was beautiful. Since we watched the*

movie for lesson purposes, taking notes all the time helped us remember the subject better and be more interested in the subject we were going to learn. As a result of these activities, it was quite easy to evaluate our group friends and other groups. I made a comparison with the results I found myself, I compared the compatible ones and those that were not. Apart from taking a little too much time, it was quite productive."

T:30 "I encountered the analogy map for the first time. It took quite a while to understand and interpret at first. I was able to understand how to do it by getting support from my teacher and my groupmates. Using analogies in the lessons gave me a different perspective on the subject. Our teacher's evaluation of us as a result of the analogy map caused us to be more careful and to behave carefully."

T:19 "While we were learning about electricity, we did many activities. As a result of these activities, it would not be efficient if we took notes with a single evaluation. In addition to individual and group evaluations in each activity process, our teacher's evaluation of our notes and our behavior in the group motivated us individually and as a group. On the negative side, it takes a lot of time to constantly evaluate our friends and other groups. When making a measurement, sometimes the fact that friends look at what we have written prevents us from being objective towards them."

Content analysis was conducted using the appropriate themes, categories, and codes for the interview data. Content analysis involves comprehensively examining written statements that are similar in terms of meaning in order to ensure that readers and researchers can understand them in a way that creates integrity (Yıldırım & Şimşek, 2016). Codes with similar content are combined for ease of understanding.

4. DISCUSSION and CONCLUSION

The research on HLEs was conducted by applying alternative measurement-evaluation practices in a way that would have the students attending the physics lessons online be as active as the students attending the lessons in person. In the relating phase of the context-based teaching practices in HLEs, effective communication was ensured between the students who participated in the lesson online and face-to-face; they were also ensured to share their knowledge in their interactions. In addition, the use of movies that would attract students' attention during the relating phase in the context-based teaching process increased the students' interest in physics subjects. As a result, their voluntary participation in the individual and group activities was also ensured. Due to hybrid learning being a process in which students in different learning environments are provided with interactive learning activities, students who attend the course online may be at a disadvantage with regard to their learning. Including context-based practices in learning activities as well as peer measurements during the assessments-evaluations encourages students to be active throughout the process and requires them to concretely present their contributions to the group work. Murray *et al*.'s (2012) research revealed positive developments to occur more with students' success and attitudes as the rate of interaction among the students who attend the course online increases.

Although online-supported context-based learning is not new, student-centered measurement-evaluation practices within the scope of context-based education in HLEs are lacking in the literature. Many teachers assume that they will apply context-based learning applications in online environments within the scope of technology-assisted teaching applications if it is needed in their daily lives. However, one of the essential stages of context-based learning applications is the use of measurement and evaluation activities that make students active throughout the process. The focus is not on the technology itself in online and HLEs but on the context-based activities they support and the measurement-evaluation practices that will make students active throughout the process. For example, Pathoni *et al*. (2021) revealed context-based measurement applications to be something students in physics lessons in online environments need, but these applications do not provide a type of teaching that will make students active. Similarly, Sulistiyono *et al*. (2021) expressed the need to enrich teacher guide materials in context-based applications in online environments; however, they did not present applications related to the content of measurement-evaluation applications that will keep interactions at high levels throughout the process.

The use of peer group measurements-evaluations as an assessment tool in the relating stage of the context-based teaching process in HLEs encourages all group members to construct the knowledge they have learned over the past years. This is because the other groups consider having even one person in a group not take on a role or fulfill their responsibility to be a negative aspect. In such a case, the scores of each member in that group will suffer. The use of peer and peer group measurements and evaluations during the relating stage contributes to effective learning in individual and collaborative environments. The reason for this is revealed as the evaluation of the teaching activities carried out during each stage of the process. The use of both peer and peer group assessment-evaluation tools encourages students who attend the class online as well as those who attend in person to engage with the course at higher levels. Freeman's (1995) research revealed peer and peer group assessments and evaluations to encourage students to be actively involved in the learning process.

As a result of the document review, assessing and evaluating students' learning processes in the relating and experiencing-applying stages in context-based applications contribute significantly to their learning outcomes. The reasons for this can be shown as learning each learning outcome and writing it down on worksheets alongside the justifications and then having the teacher evaluate these at the end of the lesson and give feedback to the students. In order for students to be successful as individuals on the document review, all group members must actively participate in the process in the group activities, which emphasizes that the program objectives were fully learned in group interactions at other stages. As a result of the use of rubric forms as a measurement tool in the relating phase, activities suitable can be planned for the level of students in order to eliminate their learning deficiencies by revealing the level at which students have learned the subject's preliminary information. Researchers are recommended to develop alternative measurement tools that can reveal students' readiness levels during the association phase. Corcoran *et al.*'s (2004) research revealed having students evaluate individually and in groups by applying the alternative assessment and evaluation practices while implementing activities in the process of learning in-depth knowledge of science concepts encourages students to learn.

The use of analogy maps as an assessment tool is not a frequently encountered situation in physics teaching. Within the scope of the results obtained from these research data, informing the students about analogy maps at the beginning of the subject would be beneficial. In addition, during the cooperative and transferring stages, having students measure and evaluate the learning process individually by using analogy maps and then finish it by measuring and evaluating the groups with the help of analogy maps would contribute to students' in-depth knowledge of the subject and its concepts. Other researchers are recommended to examine the effectiveness of analogy maps by using them in the relating and experiencing stages.

Including life-based practices is important while carrying out measurements and evaluations within the scope of context-based learning. In order to raise to higher levels high school students' interests and motivations as a generation intertwined with technology and to enable them to learn about subjects and concepts in a qualified way, having them write movie scenarios related to the subject and concepts within the scope of their interests and shoot these scenarios as short films contribute to the teaching objectives. Having them print out and implement the movie scenarios in the collaborative and transfer stages contributes to the realization of learning in a more qualified manner. The reason for this can be shown activities helping students realize how to transfer concepts to new situations after teaching them. Chase *et al*.'s (2019) research stated that transferring concepts newly learned in science to new situations is a high-level learning activity. Including practices that will appeal to students' interests and attitudes is encouraged so that transfer to new situations can occur.

In context-based learning, the peer measurement and peer group measurement scores in the relating stage were determined to be lower than the scores in the collaboration and transfer stages. The fact that students had continued their group work interactively for a long time shows this to lead to more successful results with regard to collaborations with the subjects to be learned. In this context, the inclusion of alternative measurement and evaluation practices in all processes while conducting teaching practices shows that students learn subjects and concepts in depth, and this leads them to apply the subjects and concepts to new situations.

Syafril *et al*. (2021) compiled research from different countries of the world over the last 10 years. In this context, hybrid learning environments in countries such as Taiwan, Belgium, Indonesia, England, and Germany were shown to reveal practice deficiencies to exist regarding practices that enable learning activities in the collaboration and transfer stages despite their contribution to students' problem-solving skills.

Declaration of Conflicting Interests and Ethics

The author declares no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number**: Usak University, 08/03/2022-2022/10.

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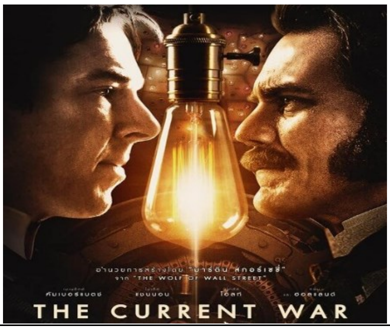
APPENDIX

The Current War is a 2017 American historical drama film inspired by the 19th century rivalry between Thomas Edison and George Westinghouse over the power distribution system in the United States. Directed by Alfonso Gomez-Rejon, the film was released in the United States on October 25, 2019. The film received generally mixed reviews, with praise for the actors' performances and engaging story, but criticism of the general execution. Take note of the following concepts while watching the movie "The Current War."



Concepts	Events in the movie	Time
Concepts		
Electrical voltage		
Electrical current		
Resistance		
Brightness		
Electrical energy		

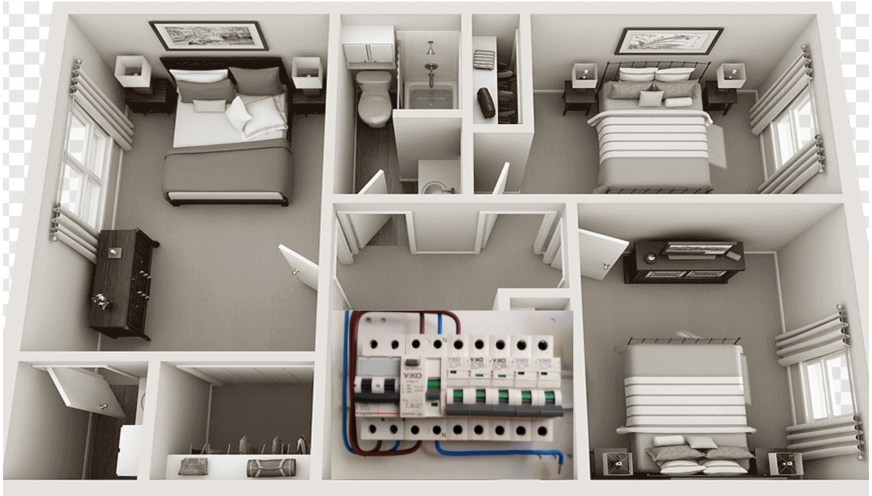
After watching the movie and completing the sections in the table, fill in the following peer evaluation form by giving points in the range of (1-5), taking into account your interaction as the group members in the process of filling out the joint group form. “1” is the lowest level, “5” is the highest level.

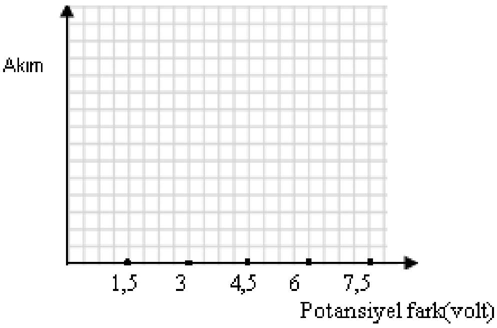
Criteria	1.My friend	2.My friend	3.My friend	4.My friend	5.My friend	According to me I
Participates in studies voluntarily						
Shares what he knows with his friends						
Helps friends when needed						
Gathers information from different sources						
Respects the opinions of his group mates						
Duty responsibility is at a high level						
Likes to work together						
Contribution to the formation of the group idea						

Evaluate other groups based on group presentations and discussions.

Criteria	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Presentation						
Accuracy of information						
Collaboration of group members						
All group members fulfill individual responsibilities						
Interaction of group members						
Task sharing competence						
Persuasion competence						
Learning competence of group members						

Anıl, who graduated from the university and became an electrical engineer, bought a land and built a small house on this land where he could rest with his family on weekends. Draw the project of the electrical lines and make the experimental application on the electrical circuit by drawing the project that can be done according to the principle of not affecting the other parts when there is a deterioration in one part of the house related to the lighting.





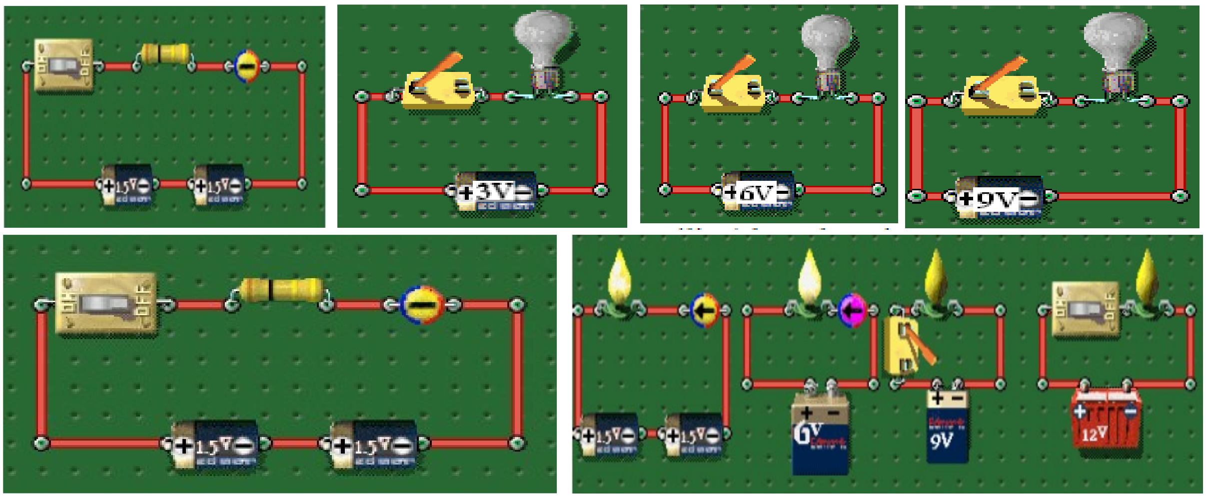
Ölçüm No	Potansiyel Farkı(volt)	Akım (amper)	Potansiyel farkı/akım
1	1.5		
2	3		
3	4.5		
4	6		

Are current and potential difference the same thing?

Some of the students studying in high schools think that the concepts of current intensity and potential difference are the same concepts, however, this is wrong information.

The phenomenon of moving +1-unit charge in conductive materials in a unit distance in the electric field with the help of electrical forces is called potential difference. The movement of electrons in the conductor by the half of the electric field strength is called electric current intensity. In this case, it turns out that electric potential difference and electric current intensities are different concepts.

Draw the electrical wiring of the house project using the Edmark simulation program.



A farmer living with his wife in the village makes a living by allocating five decares of land to himself and five decares of land to his wife. For each born child, he buys five acres of land from where he lives and increases his land gradually. After a certain period of time, something has caught the attention of the farmer, whose land has increased considerably. Although it increases its land so much, the total product increases, but the amount of product falling on itself does not change.

Similar feature	Compare	Simulated feature
Amount of Land	Comparable	Electrical voltage
Total Product	Comparable	Electrical current
Product amount per person	Comparable	Electrical voltage/Current
Farmers	Incomparable	Generator

Write a movie scenario in which the basic concepts of electricity are used practically, together with your group mates.

With your friends, shoot the movie that you have determined the scenario of as a short film so that all the group members will take an active role. Write the events in the movie in the table below.

Concepts	Events in the movie	Section time
Electrical voltage		
Current intensity		
Resistance		
Luminescence		
Electrical energy		