



Implementation of Ergonomics Approach in Sociology Learning to Decrease Physiological Disorders of Student Online Learning

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Abstract: Online learning activities carried out by students spend several hours a day in front of computers and smartphones. If the activities in this learning are not aligned with the ergonomic approach in each student's activity, of course, it will cause subjective fatigue experienced by students. This study aims to determine the influence of the implementation of the ergonomic approach on sociology learning on the decrease in physiological disorders assessed from subjective fatigue in high school students, especially in class XI. This research is an experimental study with treatment by subject design. The target population in this study was all students enrolled in SMAN 3 Tondano, while the affordable population was students who received sociology subjects. The research sample was 30 students. The research instrument used was a questionnaire of 30 items of rating scale to assess subjective fatigue. Data analysis used through descriptive tests, data normality tests, and T-tests using SPSS 25 for IOS analysis. The results showed that the difference in the average subjective fatigue before the learning process between the control period and the experimental period was 0,40 or the difference only reached 1,27%. The difference in the average subjective fatigue after the learning process between the control and experimental periods is 31,44, or the difference reached 37.36%. The results of the different tests showed a meaningful difference ($p < 0.05$). The difference in subjective fatigue reduction between the control and experimental periods reached 31.04 (62.18%). Therefore, it can be concluded that implementing an ergonomic approach to sociology learning can reduce subjective complaints in the learning process so that students avoid health problems and physiological disorders in the form of physical fatigue.

Keywords: ergonomics approach, sociology learning, physiological disorders, online learning, senior high school

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INTRODUCTION

Usually, learning activities involve some people who are carried out conventionally having to come together and carry out a series of activities to achieve a predetermined goal (Ridha, 2021). During the Coronavirus Disease 2019 (COVID-19) pandemic, the policy of enforcing restrictions on community activities issued by the central and regional governments, one of them is the implementation of distance learning activities or online learning implemented to prevent the spread of COVID-19. The policy was implemented to avoid crowds that could potentially arise clusters in the learning environment.

Policies issued by implementing online learning have received much support for the safety of students. However, learning carried out online causes concerns that impact the quality of incompetent human resources (Ridha, 2021). In Indonesia, online learning activities are not new, but the ability and experience of educators to implement them are still very limited. In addition, online learning has different challenges than conventional or face-to-face learning.

This online learning also creates pros and cons among students after running for some time, such as internet quota, inadequate facilities and infrastructure, fatigue and health complaints experienced. In addition, the positive implications are in the form of a learning system that transforms the digitization system, such as the use of Zoom meeting, Google Meet, Google Forms, and a learning management system. The Minister of Education and Culture issued Circular Letter Number 4 of 2020 concerning the Implementation of Education Policies during the COVID-19 Emergency. Then all educational institutions carry out online learning activities from home. In the circular, it is said that learning activities and tasks can vary. Evidence or products of activities are given qualitative and helpful feedback from teachers without being required to give quantitative scores/grades.

Online learning activities carried out by students spend several hours a day in front of computers and smartphones. If the activities in this learning are not aligned with the ergonomic approach in every student activity, it will undoubtedly cause subjective fatigue experienced by teachers and students. If this activity is carried out continuously and repeatedly for a long time, it will impact students' health and learning outcomes.

This is because, in learning activities, teachers and students do not understand the importance of applying ergonomics in learning activities.

Ergonomics is a science, art, and technology that integrates tools, machines, and its work environment to create efficient, comfortable, safe, healthy, and adequate working conditions so that work productivity is achieved as high as possible (Manuaba, 2000). Ergonomics of education relates to the interdependence of educational performance and educational design. The premise of educational ergonomics, embodied in the above quote, is that: student performance and educational system to a substantial degree are a particular context, specific concerning certain design factors, and ergonomic interventions directed at improving design so that they can benefit education. Scientifically, this field deals with how and why the design of the characteristics of educational processes and systems affects the variability of participants' performance in the system as a whole (Smith, 2007).

Rabada & Artazcos (2002) state that the school environment should be safe, risk-free, and comfortable for students. The teacher interacts with the students and is constantly busy adapting to bring new ideas to teach, following the demands of society (Brackett et al., 2011). On the other side, Kovač et al. (2013) confirm that teachers in schools face challenges every day and, at the same time, focus on healthy ergonomic systems in schools. They interact with humans and machines to maintain teaching productivity and teach students innovatively. However, in schools, ergonomic systems combine many elements from micro to macro, such as school furniture, school bags, equipment used for sports, classrooms, lockers, computer laboratories, timing, curriculum, schedules, content, and pedagogy (Straker & Pollock, 2003). Kaya and Romanescu (2020) highly recommend introducing educational ergonomics programs for students at the university to provide awareness.

Obstacles that are often encountered related to the socialization of ergonomics in learning in order to improve teacher professionalism are: (1) unknown, understood and understood ergonomic rules that can be used as a reference or standard in designing facilities and infrastructure and as a learning process; (2) if the rules of ergonomics are already known, but because they are more concerned with specific methods of learning, then the standards applicable in ergonomics are often ignored or supported; (3) there are no known consequences that will arise if the facilities and infrastructure and learning methods are not in accordance with ergonomic rules so that the learning process does not consider the abilities, abilities, and physical limitations of students; (4) there are teachers who are rather arrogant and consider that what they apply in the learning process is excellent and correct, even though they have not included ergonomic elements or have not referred to the physiological responses of body organs that will receive a negative impact from a long time. Proseses of learning accompanied by facilities and infrastructure that are not ergonomic; (5) due to economic considerations, time allocation, and costs that must be incurred to design an ergonomic study room, the ergonomics reference is often ignored because there is a presumption that if you include ergonomic rules, the cost will swell; and (6) the application of ergonomics in learning that requires innovative, proactive, and productive teachers is often not available in schools so that the principle of highly applicable ergonomics remains within the limits of discourse (Solikhin, 2022).

In a preliminary study at SMA N 3 Tondano, it was found that sociology learning in teaching and learning activities still does not pay attention to aspects of ergonomic approaches, such as the lack of paying attention to students' sitting attitudes during online learning, writing procedures at power points, the distance of eye interaction with computer or smartphone media, inadequate lighting intensity, non-optimal air circulation, and monotone learning. The ergonomic approach is a learning process approach by applying a total ergonomic approach. A total ergonomic approach combines the concept of applying appropriate technology and the SHIP approach (systemic, holistic, interdisciplinary, and participation) (Manuaba, 2003).

Based on previous research, there are similarities. This can be seen in the research object, including learning using an ergonomic approach. It is related to the research conducted by Jabeen and Hussain (2022), which states that the Master introduces proper physical exercise in the classroom to keep children healthy and active during school hours and provide postural awareness to develop proper posture. Parental counseling on ergonomic risk factors is recommended, along with ergonomically designed furniture in the classroom, and the use of lightweight material backpacks is also recommended. Then the research conducted by Solikhin (2022) shows that: 1) Participatory Ergonomics Praxis (PEP) through learning support facilities encourages the achievement of improving the quality of learning. 2) The application of participatory ergonomics can increase human resources (HR) self-awareness in educational institutions by contributing to managing the learning infrastructure. 3) Education quality can be improved through the support and availability of infrastructure in its implementation and its needs per the participatory ergonomic principles. Research conducted by Tigli et al. (2020) presents that no difference was found between musculoskeletal pain and activity prevention, exercise behavior, decision-making balance cons scores, and physical activity levels among those who received and have not received posture and ergonomics training. Our results showed that there is a need for further studies to be conducted with longer training durations.

There is much research on applying ergonomics to learning activities, including the design of learning

facilities, study rooms, and a combined learning model. However, online learning activities are a new thing to do a particular study that discusses the implementation of ergonomic approaches to sociology learning to physiological disorders of students during distance learning. The research intends to determine the influence of the implementation of ergonomic approaches on the development of sociology on the physiological disorders of students.

This research article contributes to improving the quality of student health through an ergonomic approach to online learning activities. This article also provides advice for further research on the development of online learning activities. Based on the problems that have been described, it is considered very necessary to conduct research on learning with an ergonomic approach. The goal is to create a process in learning activities to be more dynamic and sustainable by paying attention to the health of students during the learning process.

METHODS

This research is an experimental study with a treatment by subject design. The same design of the subject is serial design, where all samples underwent treatment 1 and treatment 2 in different periods (Bakta, 2020). In this design, the interval between the periods required washing out to eliminate the effect of the first treatment on subsequent treatments. The target population in this study is all students enrolled in SMA N 3 Tondano. In contrast, the affordable population is students who receive sociology subjects, starting from classes X, XI, and XII. Based on the considerations required by Pocock and the grade level that received sociology lessons, class XI was selected as a research sample of 30 students.

This research procedure is divided into two stages, namely the preparatory stage and the implementation stage. At the preparatory stage, the activities carried out are (1) briefing all research subjects on the procedures and steps they prepare and undertake during the research and data collection process, (2) preparing all the necessary completeness to compile teaching materials and student worksheets between researchers and class teachers, accompanied by the provision of completeness of learning preparation following the curriculum, (3) setting up an anthropometric measurement form, (4) preparing and providing training to data collection officers, (5) data collection on the condition of the research subjects, namely regarding age, height, weight, and (6) structuring (set-up) learning infrastructure that has been determined as an experimental period.

The implementation stage in this study is divided into three parts: before the learning process begins, when the learning process takes place, and after the learning process is completed. The steps taken are (1) measurement of environmental conditions such as wind speed, room temperature, light intensity, relative humidity, and noise level, and (2) data collection of physiological disorders assessed from subjective fatigue with 30 items of rating scale questionnaires from IFRC (International Fatigue Research Committee of Japanese). Statistical analysis to test the hypothesis uses the paired sample t-test with a significance level of 0.05 with the help of SPSS 25 for the IOS program. The test is used for significant differences in the post-test scores of the experimental and control groups.

RESULT AND DISCUSSION

Characteristics of the subject

The results of the subject descriptive analysis test can be observed in Table 1.

Table 1. The result of a descriptive analysis of the characteristics of the subject (n=30)

Variable	Mean	SD
Age (year)	16,06	0,44
Height (cm)	167,71	5,13
Weight (kg)	60,06	16,91
BMI (kg/m ²)	21,65	4,61

SD: Standar Deviation

Table 1 shows the characteristics of the subjects of the study totaling 30 students. The state of the subjects that are the focus of this study is age, height, weight, and body mass index. The analysis found that the average age of students was 16.06 years, with an age range of 15-17. Based on the average age of students, students are classified as productive, which means that their physical and muscular abilities are maximized. This is supported by the statements of Kroemer and Grandjean (2007) and Sutajaya (2019), where age conditions strongly influence the physical abilities of each individual. The findings are supported by other studies, such as; Irawati (2010), who researched muscle stretching in between learning, found that the age range of class X students at SMK Pariwisata Triatmajaya Badung was between 15-17 years old. Nugroho (2014) researched

learning using a participatory ergonomic approach based on portfolio assessment and reported that class X high school students were 14-17 years old. Yuliyanto et al. (2015), who researched the development of passive stretching activities, reported that the range of 36 class X students of SMA Negeri 2 Mojokerto as research subjects was 15 to 16 years old.

The average student height is 167,71 with a range of 147 to 176 cm, while the average student weight is 60.06 with a range of 39-99 kg. The average Student Body Mass Index is 21.65 kg/m². Based on students' average height and weight, it can be said that the average student body mass index is in the ideal category. The average body mass index of students in this study showed that students were classified into a standard category with a range of 16,8 to 31,7, so this is not the cause of general fatigue in students. The same is also supported by research from Oktaviani et al. (2012), which examined the relationship between fast food consumption habits and showed that the average body mass index of SMA Negeri 9 Semarang students is in the range of 18,50 - 24,90 which is classified as normal nutritional status. Suprpta (2012) researched biotechnology learning with an ergonomic-based STM approach and found that an average BMI of 32 samples was 21,08 kg/m² and classified as a normal category.

The Learning Environment Conditions

The results of the descriptive analysis test on the conditions of the physical learning environment can be seen in Table 3.

Table 2. The results of a descriptive analysis of the conditions of the learning environment

Variable	Control Period		Experimental Period	
	Mean	SD	Mean	SD
Temperature (°C)	26,62	1,52	25,27	1,38
Relative humidity (%)	81,54	7,46	79,21	6,94
Light intensity (lux)	223,18	15,78	236,93	12,47
Air circulation (m/dt)	0,46	0,08	0,11	0,04
Noise (dBA)	59,71	6,71	53,56	3,53

SD: Standar Deviation

Table 2 above shows the results of a descriptive analysis of the conditions of the student learning environment during distance learning (online). Environmental conditions that became the benchmark in this study included room temperature, relative humidity, lighting intensity, air circulation, and noise in the study room. The study's results showed that the average temperature of the study room used in the control period was 26,62 °C, with a relative humidity of 81,54%. In the experimental period, the average room temperature was as large as 25,27 °C, with a relative humidity of 79,21%. Based on the average room temperature and relative humidity, it can be said that the study room is under the comfortable category. According to Manuaba (2008), the comfort for acclimatizing dry temperatures in Indonesian society is as large as 22-28 °C, while wet temperatures are as large as 18-24 °C. Environmental conditions are below this comfortable category because the study area is a highland area with an altitude above 600 meters above sea level. This finding is in line with Pungus and Tirtayasa (2011), which found an average dry temperature of 23,68 °C and an average wet temperature of 21,62 °C.

The study results for the average lighting intensity in the study room during the control period were 223,18 lux, while in the experimental period, it was 236,93 lux. The average lighting is categorized as comfortable. In line with this, Jayanthi (2011) said that the comfortable light intensity range is 200-500 lux. In this case, good lighting will help students see something in the study room to the maximum so they can feel comfortable in the learning process. So it can be said that the lighting level is an essential factor in the learning process.

The average air circulation found in the control period was 0,46 m/s, while in the experimental period, it was obtained at 0,11 m/s. It states that air circulation in the control period was 0.3 m/s higher than in the experimental period. In addition, the average air circulation is classified as a comfortable criterion with a range of 0,1-0,2 m/s (Grandjean, 2007). Manuaba (2008) also conveyed that air circulation exceeding 0,20 m/s can have effects that can inhibit the learning process, such as dehydration caused by air circulation that exceeds normal limits. This is in line with research conducted by Haqqi et al. (2018), which examined innovative learning of the ergonomics-oriented jigsaw type with an average result of air circulation in the study room of 0,17 m/s which means that it is still classified as comfortable conditions.

The average noise obtained in the study room during the control period was 59,71 dBA, while during the experimental period, it was 53,56 dBA. The average noise in each period can be categorized as comfortable

because the average noise is above 50 dBA (Grandjean, 2007). This study's results align with the research conducted by Haqqi et al. (2018) from the results of noise indicator data reported at 62,13 dBA and categorized as comfortable. Based on the research results on the analysis of environmental condition data that has been conveyed above, the conclusion can be drawn is that the student's learning environment is classified as a comfortable category. This is obtained through temperature indicators. Relative flexibility, lighting intensity, air circulation, and noise are in the comfortable category.

Caldwell (1992) in Grandjean (2007) has answered this question concerning the physical design of classrooms. His research identifies seat design, air quality, and noise as crucial design factors needed for improvement. It estimates that poor classroom design and maintenance can lead to a decrease of 10-25% in student performance. It is tempting to conclude that Caldwell's findings also apply to elementary, middle, and high school classrooms. More research is needed to ascertain which classroom design features the most critical environment that affects student performance across different classes and for students of different ages and personal characteristics.

Subjective fatigue in the learning process

Table 3. Subjective Fatigue Data Normality Test in The Learning Process

Variable	Control Period				Experimental Period			
	Mean	SD	p	info	Mean	SD	p	info
Before the Learning Process	31,45	0,74	0,00	NN	31,05	0,71	0,00	NN
After the Learning Process	81,63	20,5	0,84	N	50,19	12,55	0,75	N
Differences After and Before the Learning Process	50,18	19,62	0,79	N	19,14	11,62	0,48	N

Info. N: Data Normality; NN: Data Not-Normality

From table 3, the average score before the learning process in the control period was 31,45, and the experimental period was 31,05. After learning, the average score for the control period was 81.63, and the experimental period was 50,19. The lowest total score in the 30-item fatigue instrument is 28, and the highest is 120. Based on this range of lowest and highest scores, the interpretation of subjective fatigue level scores can be interpreted as follows: the average scores of 30-52 are low fatigue, 53-75 (medium), 76-98 (high), and 99-120 (very high).

Thus, the subjective fatigue of the control period and the experimental period before the learning process belong to the category of low fatigue. In contrast, after the learning process, the subjective fatigue in the control period becomes fatigued with a high category, and in the experimental period is exhaustion with a low category. From table 4, it is also shown that the data on subjective fatigue in the experimental period is normally distributed and abnormally. Based on the existing provisions, the data is analyzed by different paired sample t-test.

Table 4. The results of the test differed subjective fatigue with an ergonomic approach in sociology learning

Variable	Control Period		Experimental Period		t	Sig.	Info
	Mean	SD	Mean	SD			
Fatigue before the learning process	31,45	0,74	31,05	0,71	0,40 (1,27%)	0,38	ND
Fatigue after the learning process	81,63	20,5	50,19	12,55	31,44 (37,36%)	0,00	D
The difference between fatigue after the learning process and before the learning process	50,18	19,62	19,14	11,62	31,04 (62,18%)	0,00	D

Info. ND: Not-Different; D: Different

From table 4, the difference in the average subjective fatigue before the learning process between the control and experimental periods was 0,40, or the difference only reached 1,27%. The results of the different tests showed a meaningless difference ($p > 0,05$). The difference in the average subjective fatigue after the learning process between the control and experimental periods was 31,44, or the difference reached 37,36%. The results of the different tests showed a meaningful difference ($p < 0,05$).

The different tests of subjective fatigue differences after and before the learning process showed a meaningful value ($p < 0,05$). The difference in subjective fatigue reduction between the control period and the

experimental period reached 31.04 (62,18%), which means that there is a significant difference in the occurrence of a decrease in subjective fatigue after and before the learning process ($p < 0,05$). The sociology learning process causes a decrease in fatigue by applying an ergonomic approach in the form of stretching muscles in learning activities for 15 minutes every 2 hours of learning and applying the 20:20:20 method, which means that every 20 minutes of learning, students are instructed to take their eyes off the computer for 20 seconds with a visibility of 20 feet (6 meters) so that students in the online learning process continue to move more dynamically, not just sitting statically listening to the teacher's explanation and interrupted by online learning that continues to stare at the computer can be avoided. This finding is reinforced by [Irawati \(2010\)](#) that by stretching the muscles in between learning, 80,94% can reduce fatigue. [Hastuti and Rina \(2017\)](#) stated that workplace stretching exercises could significantly reduce learning fatigue ($p < 0,05$) in Poltekkes Surakarta students.

Fatigue can be caused by physical or mental stress. Pain in the skeletal system and human muscles as a short-term result and mental fatigue in the form of boredom with the work done as a result in the long term, so this is enough to interfere with work activities in students in the online learning process and contribute to student physical fatigue in the learning process. A way to overcome this is needed, namely by doing a stretching exercise as an active rest that functions in flexing the muscles in the focused area because it can reduce spasms due to muscle proprioceptor or muscle spindle that is activated during stretching exercise ([Indrasuari et al., 2021](#)). Through stretching exercise in the learning process, muscles can return to a state of resting length and get optimal blood circulation in this condition.

Regular physical exercise is essential [Kovač et al. \(2013\)](#). [Syazwan et al. \(2011\)](#) state that physical exercises and demonstrations for children accompanied by the awareness of ergonomic risk factors in teachers can help improve the school environment. They further asserted that school stakeholders should train their staff and prepare teachers to practice ergonomics in the classroom. Teachers make children stretch after every 40 minutes proves to be a healthy feature in students' daily routine. However, teachers must be well trained to guide students and parents. [Abubakar \(2020\)](#) and [Choudhary et al. \(2020\)](#) state that parents are also to be part of the ergonomic system, help their wards in physical exercise, and guide them to improve their sitting position at home. [Mohammadi et al. \(2017\)](#) revealed the importance of morning exercises or drills that help students stay active and build strong muscles. At the same time, [Kovač et al. \(2013\)](#) encourage the implementation of sports activities and suggest that gymnastics and swimming be included in sports that help students to maintain proper posture ([Syazwan et al., 2011](#)). [Balkó et al. \(2017\)](#) further elaborate that the regular exercise of students shown in school also positively impacts the child's overall posture and health. They further emphasized that regular exercises are becoming a mandatory component of the school curriculum, especially at the primary level, as a long-term investment for children's future. Close coordination between schools, parents, sports teachers, and doctors should be maintained for the well-being of children. For this reason, proper training is provided to parents and teachers by occupational therapists.

Teachers argue that there is a wide discrepancy between the student's physique and the classroom furniture, so the student's posture is affected. [Garcia-Acosta and Lange-Morales \(2007\)](#) agree with the argument and add that the position, dimensions, quality, and material of tables and chairs make students uncomfortable. [Alibegović et al. \(2020\)](#) and other researchers affirm that mismatched school furniture not only develops poor posture but also affects the learning process of learners. A common concern pointed out by teachers is tables and chairs that do not fit the size of the students, which is a big hurdle to producing optimal results. Because on the one hand, the teacher plays an integral role in giving direct instruction about the correct sitting position and posture ([Dharmayat & Shrestha, 2017](#)). On the other hand, they focus on student's social and emotional health in the classroom environment and provide quality education ([Flook et al., 2013](#)). [Casey \(2006\)](#) describes the role of a teacher as a caring mother who provides comfort and connection to learning and constantly repeats instructions to maintain the correct posture to protect them from musculoskeletal problems. The teacher's influence on the student due to direct interaction and emotional bonding with the student is an undeniable universal truth ([Hagenauer et al., 2015](#)). [Ryabova et al. \(2020\)](#) suggests that updating teachers' knowledge about following ergonomic practices, such as creating recreational corners and learning areas where children play safely and feel relaxed, can improve their learning abilities and reduce threats to their health. In this case, school administrators and teachers can play a significant role in creating a safe and secure school environment ([Davydova & Ryabova, 2012](#)). [Thomas et al. \(2022\)](#) affirm that students with a poor sitting position leaning on a writing table or sitting on the edge of a chair develop poor posture and have a prevalence of back pain and accelerate the duration of the occurrence of physical fatigue of students compared to children with good posture and sitting position.

[Jabeen and Hussain \(2022\)](#) express great concern for the well-being of their students. They that the poor health of students affects not only their academics but also their daily activities. They suggest that an appropriate training program concerning ergonomics and associated risk factors should be organized for teachers of all levels. They know postural education and instruct students to follow the correct posture. They

have planned to put a proper posture chart and use it to display videos about postural awareness and to develop a deep understanding in students to avoid the future consequences of bad posture. They strongly suggest that parents must be well guided for awareness of ergonomic risk factors to remain cautious and alert to their children's activities at home. Some teachers also suggest making ergonomics and its guiding principles part of the school policy that should be translated to all stakeholders such as parents, teachers, and even students.

As for other symptoms, if they do not implement an ergonomic approach in distance learning activities, it will be able to cause fatigue in the eyes called Asthenopia. Asthenopia is an eye fatigue syndrome experienced by young children when looking at laptop/desktop/smartphone monitors for a long time. Frequent focusing on different font sizes, colors, and moving screens causes severe strain on the rectus muscles and eyeball obliques, moreover in eyeglass wearers. Children are more engrossed in playing games on the computer and are unaware of the level of the eye monitor, the distance of the eye monitor, and the glare and posture in which they work. Children tend not to blink their eyes frequently when watching exciting subjects on the screen so that the lacrimation of the eyeballs is reduced and causes dry and red eyes. Direct or indirect glare, the incorrect ergonomics of the eye monitor, is responsible for eye strain and headaches and can cause myopia early in life. Headaches, irritations, and insomnia can be associated with prolonged exposure to microwave radiation from gadgets and boredom due to lockdown (Choudhary et al., 2020).

CONCLUSION

Implementing an ergonomic approach to sociology learning reduces subjective complaints during the learning process so that students in the learning process avoid health problems and physiological disorders in the form of physical fatigue. The conclusion shows that the difference in subjective fatigue scores before the learning process is obtained at 0,40 (1,27%) with a value of $p=0,38$, which means that there is no significant difference. The difference in subjective fatigue scores after the learning process is 31,44 (37,36%) with a value of $p=0,00$, which means there is a significant difference. In comparison, the difference in the score on the difference in fatigue after and before the learning process is 31,04 (62,18%) with a value of $p=0,00$, which means there is a significant difference. It is expected that every learning activity in schools, both distance and face-to-face learning, implements ergonomic approaches, such as providing active rest in between learning, conducting the 20-20-20 method to prevent eye fatigue, using participatory learning models and combinations to create a pleasant learning atmosphere for students. By implementing these, the physical fatigue experienced by students can be minimized so that productivity or learning outcomes can increase as high as possible.

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