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Relation of Facial Expressions and Student Learning Outcomes in Face Recognition-Based Online Learning

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Abstrak
Penelitian ini dilakukan untuk mengetahui hubungan antara ekspresi wajah dan hasil belajar mahasiswa yang berbasis face recognition. Pembelajaran yang diterapkan yaitu pembelajaran online dengan jumlah responden sebanyak sembilan orang pada perkuliahan statistika. Jenis penelitian merupakan penelitian kuantitatif dengan analisis statistik inferensial, software yang digunakan untuk mendeteksi ekspresi wajah yaitu software LOBE sedangkat pengambilan data hasil belajar digunakan instrumen soal pilihan ganda sebanyak sepuluh soal. Berdasarkan hasil penelitian yang dilakukan terdapat hubungan antara ekspresi wajah dan hasil belajar mahasiswa ynag dilakukan melalui uji korelasi person dengan signifikansi kurang dari 0.05 yaitu 0.001 dan tingkat hubungan keduanya berada pada korelasi sempurnah berdasarkan tabel pedoman korelasi yaitu sebesar 0.895.

Kata kunci: face recognition, ekspresi wajah, hasil belajar, software LOBE

Abstract
This research was conducted to determine the relationship between facial expressions and student learning outcomes based on face recognition. The applied learning is online, with nine respondents participating in statistics lectures. This type of research is quantitative research with inferential statistical analysis; the software used to detect facial expressions is LOBE software, while the data collection on learning outcomes uses multiple choice questions as many as ten. Based on the research results, there is a relationship between facial expressions and student learning outcomes, which are carried out through the person correlation test with a significance of less than 0.05, namely 0.001. The level of the relationship between the two is a perfect correlation based on the correlation guide table, which is equal to 0.895.

Keywords: face recognition, facial expressions, learning outcome, LOBE software

INTRODUCTION

Online learning is distance learning, which has been a part of teaching in higher education for nearly two decades (Scherer et al., 2021; Carrillo & Flores, 2020). As executors in similar activities, teachers and students must quickly adapt to the remote teaching model. Teachers can use today's technology to carry out online learning, such as video conferencing using Zoom and other applications (synchronous) (Rasmitadila et al., 2020). Online learning maintains harmony in learning (Casino-García et al., 2019). In online learning, what is difficult to control is student learning outcomes that originate from their learning motivation (Ayvaz et al., 2017). The difficulty of controlling learning is due to the lack of teacher knowledge in reading students' wishes through facial expressions shown during learning.

Studies show that students' emotions are essential for teachers to learn (Krithika & Lakshmi Priya, 2016). Students' emotional states or moods can be understood by observing facial expressions (Ueda, 2022) Zadobrischi et al., 2020). Facial expressions are non-verbal signs essential in ensuring the integrity of meaning in human relations (Ekmekci & Ozbay, 2021; Dixit & Gaikwad, 2018; Pansare & Shetty, 2017). This is equally true in learning, where teachers must be able to understand students' facial expressions to understand their wishes. At the same time, humans find it difficult to understand facial expressions caused by emotional levels (Tavakolian et al., 2019; Tonguç & Ozaydın Ozkara, 2020; Miolla et al., 2022; Ueda, 2022; Mancini et al., 2022; Casino-García et al., 2019). (2020) and Niinuma et al. (2021) explained that detecting facial expressions is essential for understanding other people's feelings in interactions.

Facial expressions detected include emotions (angry, happy, sad) and neutral facial expressions (flat). Several studies say facial expressions that are easier to detect in a visual search are more emotional than neutral ones (Saito et al., 2020). Ueda (2022) reports that a combination of facial muscles carries out facial expressions. The combination of happy and angry faces has almost the same characteristics. In the same circumstances, facial analysis cannot be identified because the positions of the mouth and eyes are similar and have no elements compared to the introduced model (Zadobrischi et al., 2020).

Face recognition is the basis of knowledge to recognize students' facial expressions when communicating in the online learning process (Ueda, 2022). Face recognition is part of computer vision, which is the most widely used facial expression recognition method in the real world (Du et al., 2022). The study's results showed that computer-assisted face recognition was successfully carried out with an accuracy of 90% (Jin et al., 2016). However, the results of other studies reveal that face recognition has problems, so an algorithm audit is needed for better detection results (Raji et al., 2020). One of the recommended algorithms is YOLOV5. YOLOV5 is an algorithm rapidly developing in face detection during the COVID-19 pandemic, but its use is still problematic due to complicated coding (Yang et al., 2020). In this study, the software used is LOBE, which automatically detects and translates images entered into the system. The choice of LOBE software is due to its easier use because it does not use coding in its operation (Hikmatiar et al., 2023).

The study aims to determine the relationship between facial expressions and learning outcomes of Physics Education Students at Universitas Muhammadiyah Maumere in online learning, which is detected by the LOBE software; it is easy for teachers to do and can be used as a reference in maximizing learning outcomes. Based on the background, the problem to be studied is the relationship between facial expressions and student learning outcomes in face recognition-based online learning.

METHOD

This research is quantitative research with inferential statistical analysis. The quantitative method is a method that processes numerical data and focuses more on the research process in measuring objective results and using statistical analysis (Rosyiddin et al., 2023). The research was conducted at Universitas Muhammadiyah Maumere. The research sample was nine students in physics education. The sample selection was done using a saturated sampling technique, namely the sampling technique, when the population and sample are the same due to the small population (Niswara et al., 2019). The selected sample is students who have conducted online lectures several times, so they have no problems using online learning applications. This is done to anticipate bias related to the use of applications when online learning takes place. The research was conducted online using the Zoom application, which is a video conference method. The research step can be seen in Figure 1.

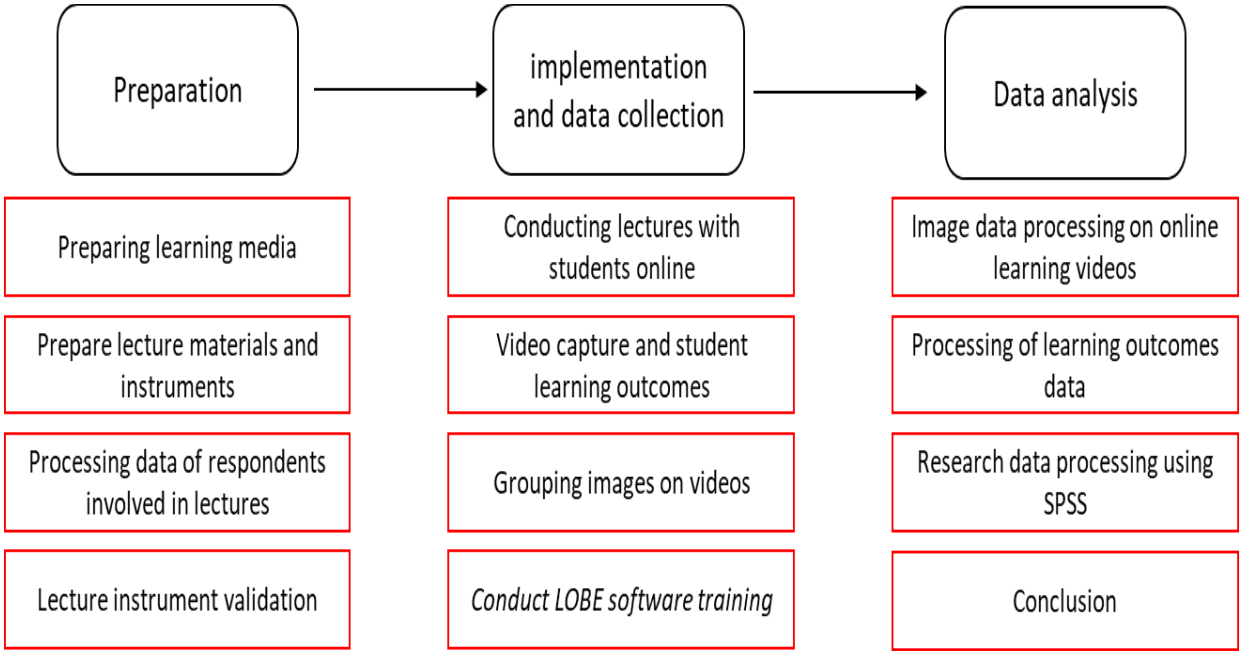

Figure 1. Research step

Based on Figure 1, research activities were carried out in stages, from preparation, implementation, and data collection to data analysis. Of course, the stages carried out in the three mentioned have smaller sub-stages, which are done to achieve what you want to accomplish in the research. The preparation stage is the initial stage that must be completed in this research. In the initial stage, several points must be made: preparing learning media, materials, respondent or student data, and validating instruments. Once this step is fulfilled, we move on to the next stage, namely power collection and analysis.

Data Collection

The data collected as material for analysis is divided into two, namely data from image processing of facial expressions and data on student learning outcomes online. Images of students' facial expressions are collected by capturing students' faces on a PC screen during online learning. This activity occurs when students focus on studying with lecturers in online classes. The picture was taken in the middle of the lecture to show the effectiveness of the facial expressions obtained. Learning outcomes are obtained at the end of lectures after

students receive lecture material in two meetings. Data on student learning outcomes will be collected using a multiple-choice test with ten questions. Each question answered correctly has a value of 1, while wrong questions are given 0. The instrument questions used to collect learning outcomes data are validated by experts, namely as many as three experts. The expert lecturer who validates the test questions is a physics education lecturer at Universitas Muhammadiyah Maumere.

Analysis

Then, the data analysis technique used in this study was the Pearson correlation analysis test, which was assisted by the IBM SPSS 25 application. This is done to determine whether facial expressions affect student learning outcomes and how significant the relationship is according to the guidelines for the degree of relationship (Sriyati, 2023). To find out how big the relationship between facial expressions and learning outcomes can be seen in Table 1 (Amalia et al., 2023).

Table 1. Relationship Degree Guidelines

No	*Person correlation*	Description
1	0,00 s/d 0,20	No correlation
2	0,21 s/d 0,40	Weak correlation
3	0,41 s/d 0,60	Moderate correlation
4	0,61 s/d 0,80	Strong correlation
5	0,81 s/d 1,00	Perfect correlation

The software used to analyze student images is the LOBE software. Machine translation is carried out so that the model will be tested first before data collection training. The image analysis results generated using LOBE software will be reported as quantitative data (Hikmatiar et al., 2023). Image analysis techniques were carried out using LOBE software, namely by entering 5 sample images for each participant obtained from the captured images during online learning. These were processed automatically by the software and reported whether the facial expression pictures based on facial recognition were in the happy, angry, sad category, or neutral. After all facial expression data based on student face recognition were obtained, the data was entered into Excel and then analyzed using IBM SPSS 25 to determine the relationship between the two: facial expressions from LOBE software and student learning outcomes.

RESULT

LOBE Software Training

LOBE software training is conducted to train the software to have maximum results when performing image analysis. The trained images were divided into three types of images depicting three categories of facial expressions. The facial expressions in question are sad, neutral, and happy expressions. These three expressions are indicators that determine the emotional level of students based on face recognition. The results of the training in question can be seen in Figure 2.

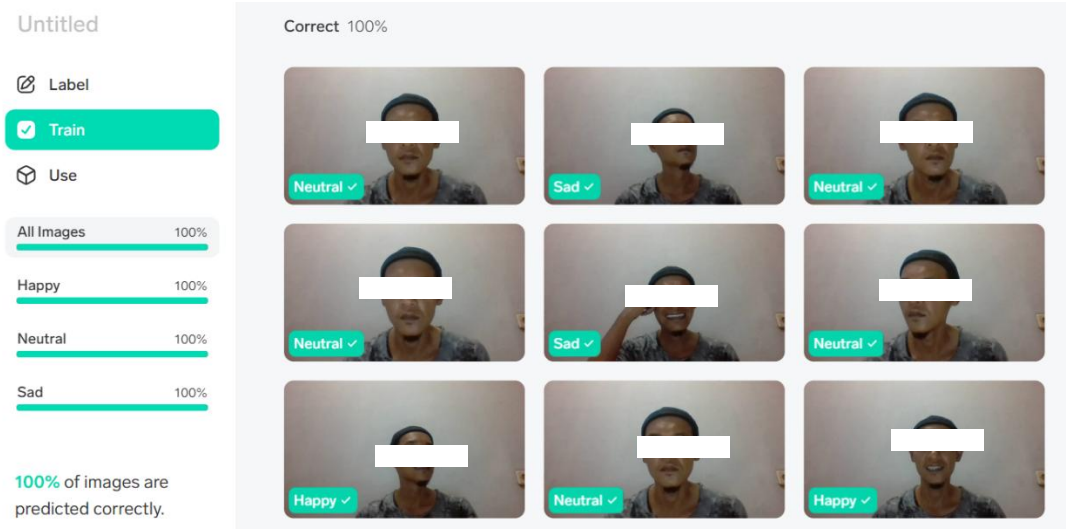

Figure 2. Results of Lobe Software Training Pictures Happy, Sad, and Neutral

Student Image Processing

After conducting research software training, results have been obtained that can be used as a guide to get images classified into three types of facial expressions: sad, happy, and neutral. At this stage, the image to be processed is a picture of a student's face from the results of online learning. The raw image can be seen in Figure 3.

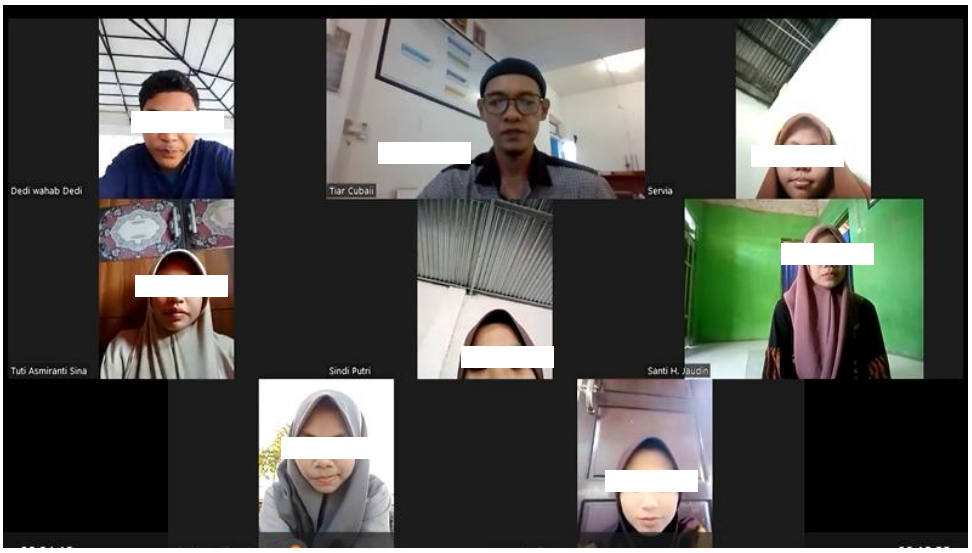

Figure 3. Screenshot Results on Online Learning

Figure 3 is then processed using LOBE software to determine student facial expressions. This is done as a form of effort to determine whether their condition is good, bad, or mediocre. This condition can be known by representing the three expressions trained beforehand, as shown in Figure 2, namely with sad, happy, and neutral expressions. The processed images of student faces can be seen in Figure 4.

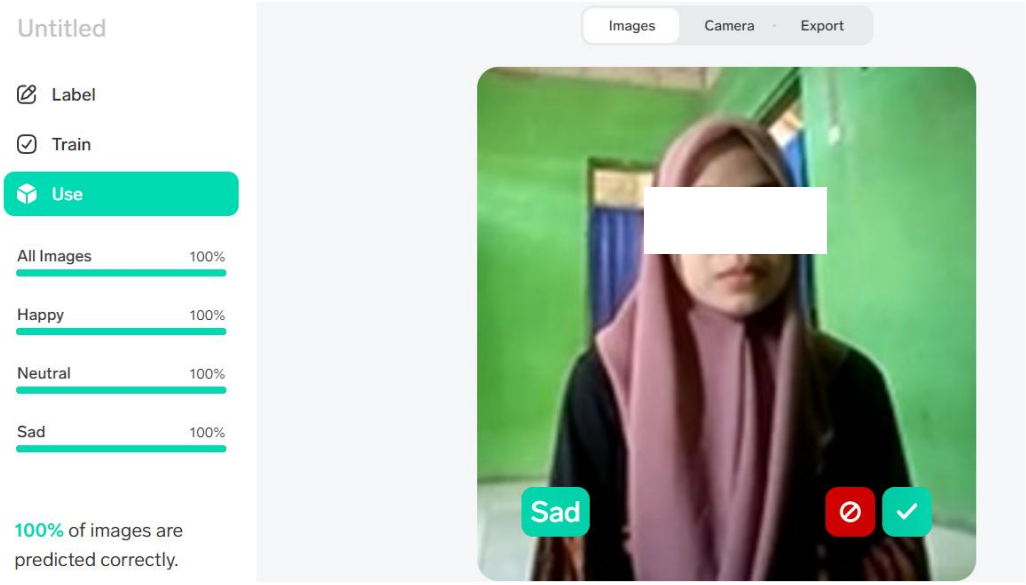

Figure 4. One of the Results of Image Processing with LOBE Software

The overall image processing results, complete with labels determined by LOBE software based on training results, can be seen in Figure 5.

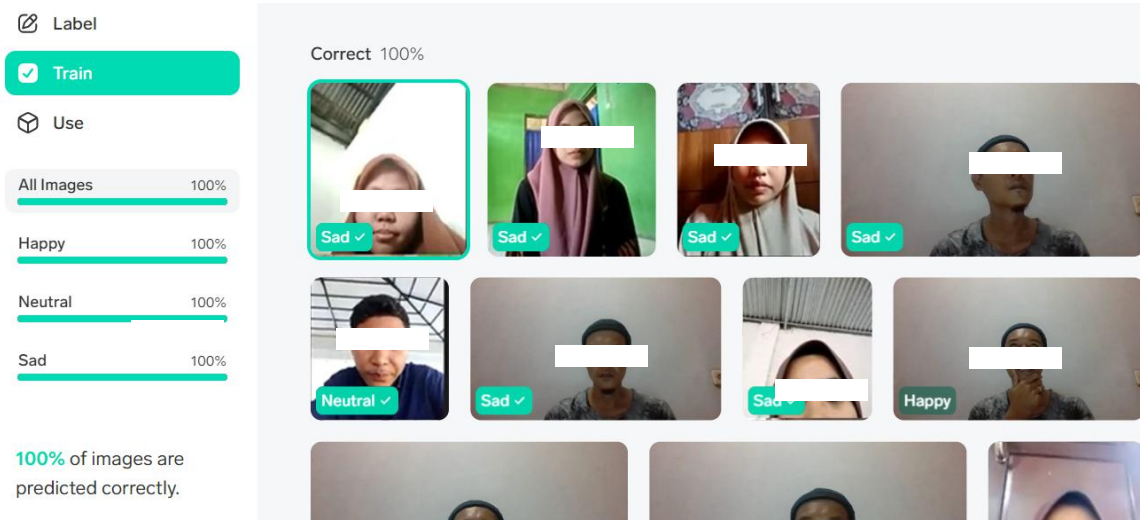

Figure 5. Display of Image Processing Results in LOBE Software

The results of the image processing that was carried out show the types of expressions that students generate when online lectures take place. Some of these expressions were detected through pictures taken at the beginning of the lecture, the results of which are shown in Table 2.

Table 2. Facial Expression Data During Lectures

No	Facial Expression	Respondent
1	Sad	5
2	Happy	2
3	Neutral	2

Facial expressions elicited by students during lectures give rise to several types of expressions that are not the same for all students; this can be seen clearly when viewed on a graph, as shown in Figure 6.

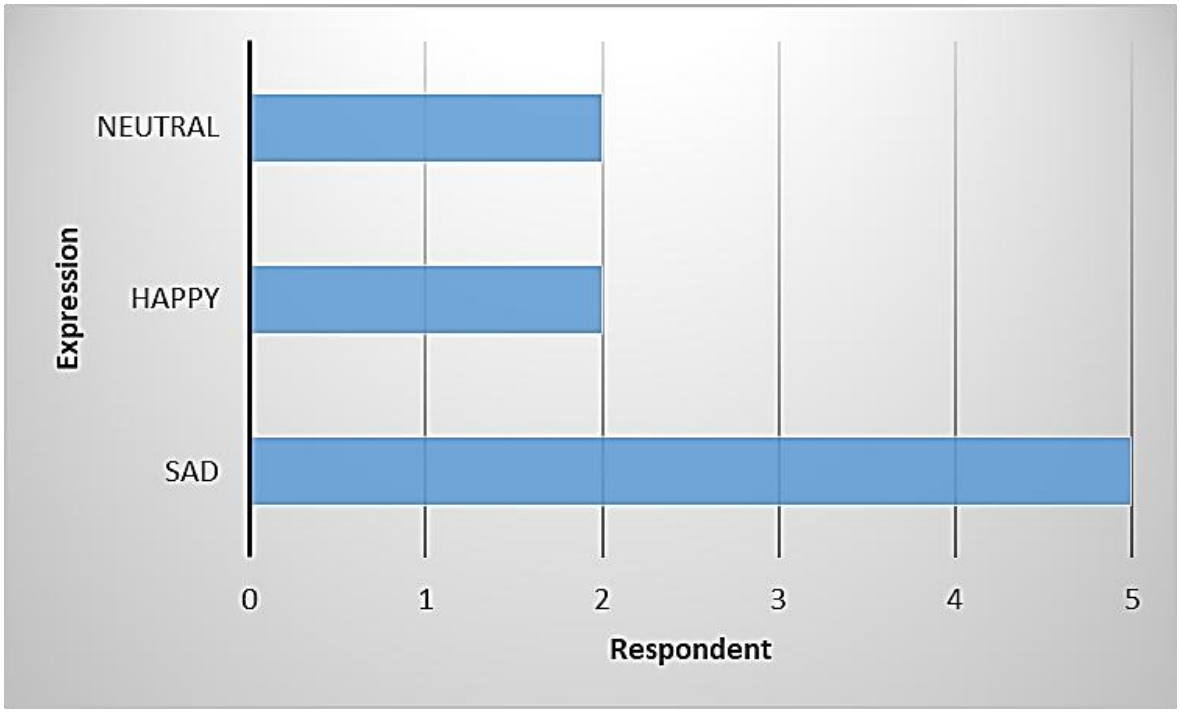

Figure 6. Expression and Number of Respondents in Lectures

Learning Outcomes

Test Instrument Validation

Instrument validation must be done with several expert validators to determine the validity of the test instrument data that will be applied to students. The results of the validation analysis can be seen in Table 3. (Sya'bania et al., 2020).

Table 3. Instrument Validation Result

No	Validity Test	Description
1	0.83	The validity is high
2	0.75	Medium validity
3	0.92	The validity is high
4	0.75	Medium validity
5	0.92	The validity is high
6	0.92	The validity is high
7	1.00	Medium validity
8	0.92	The validity is high
9	0.83	The validity is high
10	0.92	The validity is high

Based on Table 3, 10 test instruments have been validated by three experts, namely the physics education lecturer at the Muhammadiyah Teachers' Training College, Muhammadiyah Maumere. Based on the results obtained, seven instruments have validation results with a

high category, namely 70%. For validation results in the moderate category, there are three questions with a percentage of 30%.

Test Result

The test results were obtained from the learning outcomes of physics education students who had conducted statistics lectures for two meetings and then took a learning outcomes test of 10 questions with a validated multiple choice instrument type. Student learning outcomes presented in descriptive data can be seen in Table 4.

Table 4. Descriptive Statistics of Learning Outcomes

N	**Valid**	**9**
	Missing	**0**
Mean		7.44
Std. Error of Mean		0.556
Median		7.00
Std. Deviation		1.667
Variance		2.778
Range		5
Minimum		5
Maximum		10
Sum		67

Table 4 shows that the average learning outcome of 9 students who missed 0 is 7.44. The maximum score obtained is 10, meaning that all test instruments are answered correctly, while the minimum score is 5, meaning that students who receive these learning outcomes only answer five questions correctly out of 10. Of the total scores obtained, the total is 67. The frequency and presentation of learning outcomes can be seen in Table 5.

Table 5. Presentation of Student Learning Outcomes

		Freq.	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	5	1	11.1	11.1	11.1
	6	2	22.2	22.2	33.3
	7	2	22.2	22.2	55.6
	8	1	11.1	11.1	66.7
	9	2	22.2	22.2	88.9
	10	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

Table 5 shows that the maximum score is only one student with a cumulative percent of 11.1 with a percent of 100, while the minimum score is only one with a cumulative percent of 11.1. The values with a frequency of 2 students are 6, 7, and 9 with a cumulative percent of 33.3, 55.6, and 88.9 respectively.

Correlations

The analysis used to determine the relationship between students' facial expressions and their learning outcomes is using personal correlation analysis. The results obtained from the analysis with IBM SPSS 25 software can be seen in Table 6.

Table 6. Correlation Analysis Results

		Expression	Learning Outcomes
Expression	Pearson Correlation	1	-.895
	Sig. (2-tailed)		0.001
	N	9	9
Learning Outcomes	Pearson Correlation	-.895	1
	Sig. (2-tailed)	0.001	
	N	9	9

Based on Table 6, facial expressions and learning outcomes have a significance of less than 0.05, namely 0.001. Meanwhile, the person correlation has the same results, each of 0.895. The person correlation from this analysis shows the opposite relationship, which is marked by mine (-). The sign indicates if the relationship between variables has an inverse relationship. This means that the higher the value of the expression, the learning outcomes will decrease. The value in the personal correlation analysis results shows a perfect correlation between the two according to the degree of relationship in Table 1.

DISCUSSION

LOBE Software Training and Student Image Processing

The training results were carried out using the author's picture directly with three criteria for facial expressions: happy, sad, and neutral. Each image trained in the software is five images for one expression. Hence, three expressions were obtained from 15 sample images representing each student's facial expressions whose emotions will be detected based on face recognition. This method is excellent if learning is done online (Ayvaz et al., 2017).

Based on the training results, according to Figure 2, the sample images meet the requirements to be used as a benchmark for detecting student facial expressions during lectures. Figure 2 shows if the sample images meet the requirements, as evidenced by the statement, "100% of images are predicted correctly". In this section, using LOBE software dramatically facilitates the teacher's job if you want to see the emotional level of students in their lectures. This is in line with research conducted by Hikmatiar et al., (2023), which said that LOBE software does not require complicated coding to operate, so it is suitable for use by anyone.

After the training, the software is ready to process student images. Processing does not require a lot of time, meaning that this software is easy to use and very time-saving (Ekmekci & Ozbay, 2021). Introducing facial expressions is considered necessary because it can determine students' emotional level, making it easier for teachers to understand student conditions. This is in line with research (Wang et al., 2020), which detected as many as eight facial expressions to determine changes in students' emotions in online learning.

The data processing results using LOBE software had the same results, but in this study, it was only used to detect three facial expressions: sad, happy, and neutral. Based on the results of processed images obtained from 9 samples, it was found that five students had sad facial expressions, two students had happy facial expressions, and the other two were normal or neutral. These results show that learning is still done online; there are still more students who

are involved with an emotional level of sadness than happy and neutral. The research conducted by Jayasinghe & Atukorale (2019) shows that the most important thing in learning facial expressions is determining students' emotional changes.

Relation of Facial Expressions and Student Learning Outcomes

Before collecting data on learning outcomes, the instrument to be used needs to be validated first by an expert validator. In the results obtained from the validation of the test item instrument, 70% of the instruments were obtained with high validation information, while for medium validation, only 30%; this shows that the instrument used is very valid and feasible. Along with the research conducted (Lukman et al., 2023), which states the importance of validating the instrument before it is implemented to determine whether it is feasible based on the assessment criteria.

In the learning outcomes, it was obtained that the test scores were carried out by nine students with an average score of 7.44 with a maximum value of 10, while the minimum score obtained was 5. Students who received a score of 10 were one person, while a value of 5 was one person, while seven students have scores ranging from 7 to 9. This shows that student learning is done using the online method quite well compared to the average learning obtained. According to research (Rapanta et al., 2020), online learning provides new sensations and new experiences in technology-assisted learning so that learning outcomes are not inferior to offline learning.

Analyzing the relationship between facial expressions and student learning outcomes, which were carried out using person correlation, a perfect relationship was obtained with a correlation value of 0.895. While the significance is less than 0.05, which means the two variables have a significant relationship. Based on the person correlation analysis results, it also provides clues if high learning outcomes are obtained from students with happy and neutral facial expressions. In contrast, sad facial expressions have a minimum value. Two people who were detected to have happy expressions obtained learning outcomes with scores of 9 and 10, while normal or neutral facial expressions had scores of learning outcomes of 8 and 9, for scores of 5 to 7 obtained by students who were detected to have sad facial expressions.

Based on these results, it can be concluded that facial expressions that describe changes in the emotional level of students influence their learning outcomes. So, the teacher's role to know students' emotional level before lectures or during lectures is very important. This is in line with previous research conducted by (S.P et al., 2019), which explained that it is important to know facial expressions that impact insightful findings such as students who do not pay attention to material in class and the level of student distraction. The use of computers today is very helpful. It makes it easier to detect someone's emotions using facial expressions, the most effective way to show and recognize emotions (S et al., 2019).

CONCLUSION

Based on the results of the research conducted, there is a relationship between facial expressions and student learning outcomes, which are carried out through the person correlation test with a significance of less than 0.05, namely 0.001, and the level of the relationship between the two is at perfect correlation based on the correlation guide table, which is equal to 0.895. The ease of detecting facial expressions can be done using LOBE software, which does not require special skills such as coding. This means that everyone can easily use the software. As a teacher, it is imperative to know students' emotional changes

before and/or when conducting lectures or learning so that similar research can be developed again with a larger number of respondents and with even better preparation.

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