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Alternative Virtual Lab-Based Practical Learning Model to Improve Scientific Attitude and Science Process Skills

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Abstract

A virtual laboratory is computer software that has the ability to perform mathematical modeling of computer devices presented in the form of simulations. Virtual laboratories are not a substitute for real laboratories, but are used to complement and improve the weaknesses of real laboratories. This research aims to determine the effect of virtual labs on science education students' scientific attitude abilities and science process skills in science courses. The design of this research is a repeated pre-experiment without a control class, with a one-group and pretest-posttest design. The sample in this study was 60 students of the science education study program at Makassar State University, Indonesia, used as experiment 1 group A (n = 30), experiment 2 group B (n = 30). Two groups (experiment 1 and experiment 2) were tested with a pretest and posttest. Each group uses a virtual lab-based practical model (PbVLab). Scientific attitudes and scientific skills were measured using multiple choice tests before and after treatment. The mixed method ANOVA statistical test was used to determine how effective the use of PbVLab was in improving scientific attitudes and science process skills. The results of testing research based on Within-Subjects Effects showed that there was no difference between the pretest-posttest scores for scientific attitudes and scientific skills ($F = 0.00$; $p < 0.05$) in each group. The results of the pairwise comparison showed a significance value of <0.05, and there was a significant increase in the pretest-posttest scores for scientific attitudes and science process skills in each group. The effect size results (partial eta squared) show that experimental group 1 experienced an increase in scientific attitudes by 52%; science process skills 53%, experimental group 2 scientific attitudes 54% and science process skills 56%. So, it can be concluded that experimental group 1 and experimental group 2 (PbVab model) provide the most effective contribution to improving scientific attitudes and science process skills.

Keywords: alternative learning models, practicum-based virtual lab, scientific attitude, science process skills

INTRODUCTION

The industrial revolution 4.0 in the 21st century era, the development of science is very fast, for the sustainability of science and is necessary to have for to investigations. This is in line with Prisecaru's statement which said that in the era entering platform required (Prisecaru, 2016). On the other hand, during the current Covid-19 pandemic, learning on campus is carried out, in Indonesia which of high school students, is 51.93% of six science process skills indicators, i.e : observing, classifying, interpreting, predicting, formulating hypotheses, experiments, and communicating (Elvanisiet et al, 2018). The aim of this research is to answer questions 1) how is the implementation of PbLab in improving students' scientific attitudes and science process skills in studying natural phenomena; 2) is there no difference in the increase in scientific attitudes and science process skills of students in experiment 1 and experiment class 2 after participating in PbLab; 3) how big is the effect size of implementing PbLab on scientific attitudes and scientific process skills.

In addition, research conducted by students of science education at Makassar State University shows that the scientific attitude of junior high school students in junior high schools in Indonesia is very low, but after they are given learning with a approach, their science process skills improve (Bonga et al., 2017). Showed scientific literacy of Indonesian children was still low. Even though known, but scientific, be able to scientifically, The PbVLab model is one way for teachers to interact with students doing related to physical phenomena that, as stated by Gunawan, et al, 2019.

By applying the PbVLab Model to learning, it is suspected that students can be trained on scientific attitude indicators, which according to Yafie (2019), include: curiosity, respect for, discovering, sensitivity. Luo et al., 2020; Susantini et al., 2016; Martiningsih et al., 2018; Guswita et al., 2018; Priyayi, (2020), stated that scientific attitude is one of the variables that determine success in learning Natural Sciences and found in Indonesia was low on in the range of 3.2 – 4.7. Likewise, by applying a PbVLab Model to learning, it is suspected that it can train indicators, which: observation (Tawil & Liliasari, 2014; Rahayu & Anggraeni, 2017). In addition, the PbVLab Model is one of the technology applications that can make learning more detailed, more adaptive, and more interactive for students. This is in accordance with the findings of Economic Co-operation and Development (OECD) which concludes that technological innovation has implications for education that change knowledge and skills (OECD, 2021). Therefore, by applying the PbVLab Model in physics learning, it is suspected that it can help teachers to better understand how different students learn and can help the education system better match the required resources. Here, the knowledge and skills that teachers have in utilizing Information and Communication Technology (ICT) and integrating it into education is very important. PbVLab Model in physics learning improve students' scientific attitude, science process skills. Previous research was conducted survey or correlational, in this research experimental research was carried out, so that the influence of the treatment on the variables of scientific attitudes and scientific process skills was more visible.

The PbVLab Model can reduce experimentation students simulations. Through a PbVLab Model, students student, and errors, to immediately experiment the experimental results obtained will be the same as the results of the expensive PLab experiments. tall. The virtual lab overcomes some of the shortcomings of PLab, it does. Wong et al., (2020) found that applying VLab and Microcomputer-Based students understand the intent of the experiment and increase student interest. suggested VLab Microcomputer-Based Lab student. Arista & Kuswanto, (2018), combining a with an android smartphone, the learning quality is very good.

There are six (6) phases of PbVLab model steps, i.e: 1) observing, at this stage students make observations on the simulation object being investigated, 2) questioning, at this stage students ask questions or problems according to the results of observations obtained in simulation, 3) constructing, with an experiment, at this stage students carry out experiments to answer questions or problems, 4) analysis results, at this stage students analyze data from experimental, 5) results and conclusion, at this stage students make conclusions based on the findings of their investigation, 6) report results, at this stage students report the findings of the investigation through discussion (Raja, 2016). Practical topics, namely investigating: the relationship of force and surface area to the magnitude of the pressure, the relationship of mass to the magnitude of the pressure, the effect of activity (depth, gravitational acceleration, and density) on hydrostatic pressure, Archimedes' law, conditions for objects to float, float, and law Pascal, the concept of gas (air) pressure and the relationship between altitude and air pressure, the principle of pressure in everyday life, one of which is in the osmosis experiment (Rusli et al., 2020).

Scientific attitude is an individual's tendency to behave to solve problems based on objective scientific knowledge (Khery & Khaeruman, 2018). There are eight indicators of scientific attitude, namely: mindedness to (Yafie, 2019). Vasimalai, 2019, stated that scientific attitude allows humans to think rationally and is the most important outcome teaching of science.

Mutlu & Acar, (2016), suggest that virtual chemistry laboratory instruction can significantly increase scientific process skills. Indicators of science process skills, i.e: observing, inferring, measuring, communicating, classifying, predicting, operational definition of variables, hypotheses, predictions, experiments, model design , making assumptions, operationally (Tawil & Liliasari, 2014; Rahayu & Anggraeni, 2017). The main finding of this research is that implementing PbVLab can improve students' scientific attitudes and science process skills in studying natural phenomena.

METHODS

The Research Method

Design with a non-randomized control group pre-test and post-test model (Allen, 2017; Ramdani et al., 2021) as shown in TABLE 1. Before the PbVLab Model is implemented in physics learning, all an with same material.

TABEL 1. Research Design

Group	Pretest	Treatment	Postest
A	O_1	X	O_2
B	O_3	X	O_4

Remark:
O_1 and O_3: pretest scientific attitude, and science process skills
O_2 and O_4: posttest scientific attitude, and science process skills
X : treatment using PbVLab Model

Final taking static and dynamic fluids even semester of 2021-2022 in Department of Natural Science Education. This study group A (30), group B (30). Group A and B instructions, was given the PbVLab Model is done asynchronously and synchronously online.

Data Collection Tools

The scientific attitude instrument consists of 30 items and science process skills 25 item test a score range of 0-1, and a response questionnaire of 6 items. Analysis of the coefficient of internal consistency of the test using Gregory analysis and student and teacher SPS data analysis using descriptive and inferential analysis with SPSS 21.

Validation and Reliability of Research Instruments

Validation analysis using Gregory analysis (Arlini et al., 2017) as shown in Table 1. To calculate the internal consistency coefficient value (internal validation) using (1), and to determine the category in TABLE 2. The validation results show that the creativity test, and questionnaire responses, each of which the internal validation value is greater than 0,8 including the high category, this is eligible for use in the study.

TABLE 2. Gregory's validation analysis tabulation.

	Expert Assessment	
	(1 or 2) score	(3 or 4) score
weak relevance expert assessment (item is worth 1 or 2)	A	B
strong relevance expert assessment (item is worth 1 or 2)	C	D

$$\text{Internal Consistency Coefficient (Internal validation)} = \frac{D}{A + B + C + D} \quad (1)$$

Remarks:
A = Both experts give weak relevance

B = The first expert gives strong relevance. The second expert gives weak relevance
C = The first expert gives weak relevance. The second expert gives strong relevance
D = Both experts give strong relevance

Table 3. Content validation category

Interval	Category
> 0,8	high
0,4-0,8	medium
< 0,4	low

Reliability analysis of scientific attitude, science process skills tests and response questionnaires To calculate the percentage of agreements between the two raters whose data is only "yes" or "no", formula (2) is used (Grinnell, as citied in Sumaryanto et al., 2015). The results of the reliability analysis are 99 percent, 98 percent, and 98 percent, respectively; which is greater than the lower limit of the reliability coefficient .75, meaning that all research instruments are reliable.

$$\text{Percentage of Agrrement} = \frac{\text{Agreement}}{\text{Disagreement} - \text{Agreement}} \text{x}100\% \quad (2)$$

PbVLab Model increases student scientific attitude, science process skills by using scientific test instrument PbVLab Model. scientific attitude, form questions, scientific indicators: (1) attitude, (2) dicovery, (3) open-minded attitude, (4) cooperation. Science process skills, i.e: (1) observing, measuring, (2) classifying, (2) hypotheses, (3) using tools and materials, (4) interpreting data, as well as concluding, (5) communicating (Tawil & Liliasari, 2014; Rahayu & Anggraeni, 2017). The scores obtained from the scientific attitude, science process skills learning were (3) is used in TABLE 3 (Lestari et al., 2021).

$$\text{normalized gain (g)} = \frac{x_m - x_n}{100 - x_n} \quad (3)$$

Remarks:
normalized gain (g)
Xm is posttest
Xn is pretest

TABLE 4. The Normalized Gain Categorie*s*

Interval	category
g > .7	high
.3 ≤ g ≤ .7	medium
g < .3	low

conducting important know implementing PbVLab Model and independent was, namely the, carried out and independent performed, the calculated, EQUATION 4 and 5 (Lestari et al., 2021).

$$\text{Effect size} = \frac{mean\ of\ post\ test\ score - mean\ of\ pre\ test\ score}{standar\ deviation} \quad (4)$$

TABLE 5. The Effect Size Categories

Interval	Category
0 – .20	weak effect
.21 – .50	modest effect
.51 – 1.00	moderate effect
> 1.00	strong effect

Application of the PbVLab Model questionnaire. Were, Analysis of EQUATION (5) is used.

$$P = \frac{\sum K}{\sum N} x100\% \quad (5)$$

Remarks:
P : Percentage of responses
$\sum K$: the number of scores achieved
$\sum N$: the highest number of scores achieved

TABLE 6. The Category of Percentage Response

Interval	Category
81 - 100	very good
61 - 80	good
41 - 60	Adequate
21 - 40	not good
0 - 20	bad

PbVLab Model,i.e: (1) the a scientific attitude, and a science process skills score, which is significant, (2) the average scientific attitude, and a science process skills normalized gain score moderate category, (3) mean scientific attitude, and a science process skills normalized gain score between A group, B group, (4) effect size is moderate effect category, (5) the percentage of is good category.

RESULTS AND DISCUSSION

Results

Scientific attitude tests on A group and B group is in TABLE 7- 8.

TABLE 7. Tests of Normality Scientific Attitude

scientific attitude	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df_1	Sig.	Statistic	df_2	Sig.
Pretest	.15	30	.08	.94	30	.09
Postest	.15	30	.07	.94	30	.09
n-gain	.13	30	.19	.94	30	.15

TABLE 7, the significance values for the pretest are .09, posttest .09, normalized gain .15. These results indicate that the pretest, posttest, and normalized gain is normalilty distribution.

TABLE 8. Tests of Normality Scientific Attitude

scientific attitude	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df_1	Sig.	Statistic	df_2	Sig.
Pretest	.20	30	.01	.89	30	.08
Postest	.14	30	.12	.89	30	.09
n-gain	.13	30	.19	.94	30	.15

TABLE 8, the significant values for the pretest are .08, posttest .09, and normalized gain .15. These results indicate that the pretest, posttest, and normalized gain is normalilty distribution. Science process skills tests on A group and B group is in TABLE 9-10.

TABLE 8. Tests of Normality Science Process Skills

Science process skills	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df_1	Sig.	Statistic	df_2	Sig.
Pretest	.16	30	.03	.92	30	.07
Postest	.16	30	.04	.93	30	.08
n-gian	.13	30	.15	.97	30	.56

TABLE 9, the significance values for the pretest are .07, posttest .08, normalized gain .564. These results indicate that the pretest, posttest, and normalized gain is normalilty distribution.

TABLE 10. Tests of Normality Science Process Skills

science process skills	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df_1	Sig.	Statistic	df_2	Sig.
Pretest	.16	30	.04	.93	30	.08
Postest	.16	30	.04	.93	30	.06
n-gain	.13	30	.16	.95	30	.20

TABLE 10, the significance values for the pretest are .08, posttest .06, normalized gain .20. These results indicate that the pretest, posttest, and normalized gain is normalilty distribution. For "t" purposes of testing the independent data variable the mean score of normalized gain scientific attitude, science process skills on A group and B group, then the normality test and homogeneous test were carried out. The normalized gain normality test of factual on A and B group shown in TABLE 11.

TABLE 11. Test of Normality Normalized Gain

	Kolmogorov-Smirnov			Shapiro-Wilk		
Class	Statistic	df_1	Sig.	Statistic	df_2	Sig.
A	.13	30	.19	.94	30	.15
B	.13	30	.19	.94	30	.15

TABLE 11, the significance values for A group and B group normalized gain data are .15 and .15, respectively. These results indicate each A group and B group is normalilty distribution. The normalized gain normality test of students' scientific attitude on A group and B group is shown in TABLE 12.

TABLE 12. Test of Normality Normalized Gai**n**

	Kolmogorov-Smirnov			Shapiro-Wilk		
Class	Statistic	df_1	Sig.	Statistic	df_2	Sig.
A	.13	30	.15	.97	30	.56
B	.13	30	.16	.95	30	.20

TABLE 12, the significance values for A group and B group normalized gain data are .56 and .20, respectively. These results indicate each A group and B group is normalilty distribution. The student scientific attitude, science process skills normalized gain homogeneity test is shown in TABLE 13.

TABEL 13. Homogeneous test of variance

	N	F	Sig.
scientific attitude	30	.00	1.00
science process skills	30	.01	.92

TABLE 13, the significance value for the scientific attitude and science process skills normalized gain data is above .05. These results indicate of two samples homogeneous

PbVLab Model is a learning restoration that can improve student scientific attitude, science process skills. There are five phases of the steps of the PbVLab Model, i.e: observing, (2) questioning, (3) hypothesis, (4) experiment, (5) analysis result, (6) result. PbVLab Model and their relationship to each of the scientific attitude, science process skills indicators being trained is presented in TABLE 14.

TABLE 14. Fase-fase PbVLab Model

Phase	teaching activities	students activities	scientific attitude indicator	science process skills indicator
Phase 1: Observing	prepare practicum-based virtual lab software, worksheets	qualitative and quantitative observations	curiosity, respect for data/facts	qualitative and quantitative observation
Phase 2: Questioning	ask/propose problem formulations and dig up informati related to indicators	results of observations	think critically about the results of observations	observational data
Phase 3: construct hypothesis	train students' to make hypotheses	formulate a hypothesis	creatively formulate hypotheses	formulate hypotheses
Phase 4: experiment	test hypotheses through a practicum-based virtual lab	test hypotheses	discover new concepts, principles, and theories	using practical tools and materials
Phase 5: analysis result	analyze practicum results	analyze the data	open-minded and cooperative	interpret data
Phase 6: results	report practical results	discussion	open-minded and cooperative	communicatin g results

TABLE 15. Average Scientific Attitude Score

	Group	
	A	**B**
Pretest	66.63	71.83
Posttest	81.57	83.57
normalized gain	0.44	0.44

Table 15, show the value the applying the PbVLab Model in group A and group B. This student's scientific attitude scores after implementing PbVLab Model, in the a for A group and B group.

TABLE 16. Test of Paired

Pretest-Posttest	Class	N	Mean	S	df	t	Sig. (p)*
	A	30	-11.73	3.67	29	-17.48	.000
	B	30	-53.167	11.77	29	-24.73	.000

*p =.05

TABEL 16, show the applying the PbVLab Model for A group and B group with a signifikant preest, posttest scores, was scientific attitude scores applying the PbVLab Model for A group and B group. The average score of A group, B group science process skills in TABLE 16.

TABLE 17. Average Science Process Skills core

	average score	
	A Group	**B Group**
Pretest	29,63	69,06
Posttest	82,63	91,73
normalized gain	0,752	0,728

TABLE 17 show the value the in applying the PbVLab Model in group A and group B. This student's science process skills knowledge scores after implementing PbVLab Model, in the a for A group, B group.

TABLE 18. Test of Paired

Pretest-Posttest	Group	N	Mean	S	df	T	Sig. (p)*
	A	30	-53.16	11.77	29	-24.73	.00
	B	30	-22.67	8.23	29	-15.08	.00

*p =.05

TABLE 18, show the in applying the PbVLab Model for A group, B group with a signifikant (p) value preest, posttest scores, was science process skills scores applying the PbVLab Model for group A and group B.

Then an independent sample conducted average normalized gain score to test the hypothesis no alpha .05 average score of normalized gain scientific attitude of student's in applying the PbVLab Model group A and B with using SPSS version 21.
The result of independent sample t-test of average score normalized gain scientific attitude in A group, B group are in TABLE 19.

TABLE 19. Test of Independent Samples

	α	significant value
not	.05	.42
Equal variance not assumed	.05	.42

Independent sample in applying the PbVLab Model for A group and B group with is greater than .05, no in normalized gain mean of student's scientific attitude in applying the PbVLab Model is significant between A group and B group. The result of independent sample t-test of student's average score normalized gain science process skills in A group and B group are in TABLE 20.

TABLE 20. Test of Independent Samples

	α	significant value
not	.05	.34
Equal variance not assumed	.05	.35

Independent sample student's in applying the PbVLab Model for A group and B group with significant value is greater than .05, no in normalized gain mean of student's science process skills in applying the PbVLab Model that is significant between group A and group B. The results of determine effect size PbVLab Model are TABLE 21.

TABLE 21. Test of Effect Size

effect size			
Group	scientific attitude	science process skills	category
A	.52	.53	moderate effect
B	.54	.56	moderate effect

TABLE 21 shows the effect size value of student's scientific attitude in applying the PbVLab Model in A group .52, B group .54 including the moderat effect category, the effect size value of student's science process skills in applying the PbVLab Model in group A .53; B group .56 including the moderate effect category, fulfilling the requirements for the effectiveness of the PbVLab Model, of data and of the research results

The results of student responses to the PbVLab Model are in Table 22. The average student response score is 90.22%.

TABLE 22. The Results of Student Response Questionnaire Assessment

No.	Statement	%	category
1	PbVLab model instruct interesting and new	93.33	very good
2	The VLab material is very interesting and new	93.33	very good
3	Interesting and new VLab worksheets	88.33	very good
4	Fun PBVl model learning atmosphere	88.33	very good
5	After learning activities using a PbVLab, science process skills are increasing	86.33	very good
6	After learning activities using a PbVLab Model, the scientific attitude is increasing	91.67	very good
Average		90.22	very good

Discusion

PbVLab model consists of six phases, i.e: (1) Observing, (2) Questioning, (3) hypothesis, (4) experiment, (5) analysis result and conclusion, (6) report results. Student activities in following the PbVLab model, i.e: developing scientific attitude, i.e: curiosity, respect for data/facts, think critically about observations, creatively make hypotheses, find new concepts, principles, and theories, and think openly Yafie, (2019) and, Gupta (2015), and science process skills, i.e: qualitative, quantitative, and measuring observations, classifying observational data, making hypotheses about the relationship between, using practical, interpreting, as well as concluding, and communicating the results of the practicum.

This finding proves the PbVLab Model can train scientific attitude, science process skills. Wong et al., (2020), PbVLab Model can increase student interest and learning outcomes.

Table 7-11, the results of the scientific attitude, science process skills sample normality tests are all normally distributed. Table 16, the significant value of .000 is smaller than the value of .05, which is scientific attitude and t-values are -17.46 and -14.73 which indicate is greater scientific attitude.

Table 18, the "t" values are negative, respectively: -24.73, -15.06 which indicates that the posttest is greater than the procedural pretest. These results prove that there is an increase in scientific attitude, science process skills after the PbVLab Model is applied. This finding indicates that the PbVLab Model can be applied to train scientific attitude, science process skills indicators. These activities are included in the PbVLab model. Wong et al., (2020), VLab can increase student interest and learning outcomes.

The application of the PbVLab Model resulted in the same scientific attitude, science process skills normalized gain, this is evidenced no normalized gain between A group and B group. Prihatiningtyas et al., (2013); Mubarok & Mulyaningsih, (2014); Sinulingga et al., (2016); Saputra et al., (2020); Hung & Tsai, (2020), stated that science process skills require students to carry out observation, ask questions, hypothesizes, experiment, inference, and conclude activities.

Furthermore, the results of the scientific attitude effect size test for A group and B group are .52, .54 included in moderate effect and science process skills .53, .56 are included in the moderate effect, fulfilling the requirements for the effectiveness of the PbVLab Model. Active participation of students in virtual laboratory, developing scientific attitude, science process skills through VLab activities Topalsan, (2020); Aşkın & Öz, (2020).

Student responses obtained is 90.22%. This, new, increasing scientific attitude, science process skills with the PbVLab Model. It shows that by applying the PbVLab Model. Very active in responding to all activities in learning, for example digging information through observation, formulating problems/asking questions, making hypotheses, testing hypotheses through virtual laboratory, create new equations, conduct improvements in investigations related to the concepts, principles and laws of science, conduct group discussions. Mnguni & Mokiwa, (2020); Topalsan, (2020); Rusli et al., (2020), stated that through science activities in learning, it will provide opportunities for students to discover concepts, principles and laws of science through practical work on abstract science materials.

PbVLab Model students conduct experiments or experiments virtually using the Website http://phet.colorado.edu, (2021), Physics Education Technology (PhET) simulation. experiments include: (1) investigating the relationship of force and surface area to the magnitude of pressure; (2) investigating the relationship of mass to the magnitude of pressure, (3) investigating the effect of activity (depth, acceleration of gravity, and density) on hydrostatic pressure, (4) investigating Archimedes' law, (5) investigates the conditions for objects to float, float, and sink, (6) investigate Pascal's law, (7) investigate the concept of gas pressure (air) and the relationship between altitude and air pressure, (8) analyze the principle of pressure in everyday life. Opinion expressed by: Prihatiningtyas, (2013); Mubarok & Mulyaningsih, (2014); Sinulingga et al., (2016); Saputra et al.,(2020); Hung & Tsai, (2020), stated that applying the PhET simulation program in science learning activities and learning research Herga et al., (2015); Suleman & Kumar, (2019); Penn & Mavuru, 2020; Said et al., (2020), found that there was a correlation between conducting virtual experiments that would have an impact on students' science skills.

The weakness of this research is that it does not use a control class by implementing manual Lab as a comparison class to test the effectiveness of implementing the PbVLab model. This research area is very limited to two experimental classes, it is recommended that other researchers can expand it to several classes with a larger sample size. The variables of scientific attitude and scientific process skills can still be studied in more depth, especially the indicators of curiosity and qualitative observation skills, and experimental design skills.

CONCLUSION

PbVLab Model that is applied is scientific attitude, science process skills. Average science process skills normalized gain for A group and group B, respectively, was .75 and .72. The effect size scientific attitude on group A group and B respectively .52 and .54 is included in the category of strong effect, science process skills on group A and group B respectively .53 and .56 is included in the category of moderate effect. Group A and group B meet the effectiveness requirements of the PbVLab Model. The average student response results are 90.22%, only the PbVLab Model is an alternative to a virtual science practice in training students' college. This research found that the alternative Virtual Lab-Based Practical Learning Model to Improve Scientific Attitude and Science Process Skills. This research area is very limited to two experimental classes, it is recommended that other researchers can expand it to several classes with a larger sample size. The variables of scientific attitude and scientific process skills can still be studied in more depth, especially the indicators of curiosity and qualitative observation skills, and experimental design skills.

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APPENDIX

The application of a practicum-based virtual lab trains students on scientific attitude indicators and science process skills through several materials and experiments as follows.

Topics	Experiment	Lab Virtual
The concept of pressure	Investigating the relationship of force and surface area to the magnitude of pressure	http://funscience.id/hukum-archimedes/
	Investigating the relationship of mass and to the magnitude of pressure	https://phet.colorado.edu/sims/html/under-pressure/latest/under-pressure_in.html
The concept of hydrostatic pressure	investigates the effect of activity (depth, acceleration of gravity, and density) on hydrostatic pressure	https://phet.colorado.edu/sims/html/under-pressure/latest/under-pressure_in.html
Archimedes' laws	Investigate Archimedes' laws	https://phet.colorado.edu/sims/density-and-buoyancy/buoyancy_in.html
	Investigate the condition for abjects to float, and sink	https://vlab.belajar.kemdikbud.go.id/Experiments/hukumarchimedes/#/
Pascal laws	Investigating Pascal’s Lawa	http://funscience.id/hukum-pascal-2/
The concept of air pressure	Investigate the concept of gas (air) pressure and the relationship between altitude and air pressure	
	Investigating the principle of pressure in everyday life, one of which is the osmosis experiment	http://funscience.id/prinsip-tekanan-gas/