Minimizing Misconception And Improving Student`S Conceptual Learning For Motion And Force Concepts By Student Worksheet (Lks)-Based Of Cels (Combining Experiments By Laboratory Simulation)

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Abstract. The research aims to minimize misconceptions and improve students understanding of concepts. Research using a CELS-based worksheet. the study used a quasi-experimental design "non-equivalent groups pretest-posttest design". Experimental class learning using CELS-based worksheet and control class with worksheet without CELS. The research subjects were determined by cluster random sampling technique. The study was conducted at Sipirok 2 Plus Senior High School. The data of concept comprehension ability was obtained through a conceptual understanding test about Newtons laws. Data analysis was determined based on the normalized gain score normalized by the t-test statistic. The results showed that learning by using CELS-based worksheets was more effective in improving students understanding of concept skills compared to worksheet without CELS. The percentage of N-gain concept comprehension ability for experimental class students based on each aspect is in the medium category. Whereas N-gain concept comprehension ability for control class students is in a low category.

1. Introduction

The purpose of Physics learning contained in the 2013 curriculum framework is to master concepts and principles and have the skills to develop knowledge and self-confidence as a basis for continuing education at a higher level and developing science and technology. But it seems that the learning objectives of Physics that have been set by the government through the 2013 curriculum are somewhat difficult to implement, especially for material related to the concepts of motion and style. Based on observations made about learning in Newton's Law material, many Physics teachers rarely teach Newton's Law material in depth. This is because the concepts of motion and the force underlying Newton's Law are very difficult. So that not only students, but teachers also have difficulty in solving problems related to the concepts of motion

and style. In addition, sometimes students prefer to use formula-based strategies rather than follow the process of scientific learning in shaping their understanding of concepts.

This is consistent with research conducted by [1] states that around 89.47% of all students can solve problems related to the application of Newton's Laws to questions that are general in nature and have previously been taught by the teacher, in addition Large students have difficulty in drawing force diagrams that work on objects, especially for objects that are in the inclined plane, in addition to the ability of students who are lacking in drawing diagrams on the inclined plane, students also have difficulty when solving motion problems and forces whose conditions are different from the usual examples accepted by students in class. Based on these results, it is recommended to use CELS-based learning (Combination Experiments Laboratory by Simulation) as an alternative in efforts to overcome misconceptions in motion and style [1]. There so many research about CELS, first "According to the results of the present research, it can be said that the use of studio physics was effective on the achievement, motivational beliefs, and use of learning strategies of the students. Thus , this promising learning method will encourage the educators to replace the traditional instruction methods with student-centered, interactive learning methods" [2], second that has been proven that combining Real experiments (RE) with virtual experiments (VE) have a significant effect on students` envolving skills, attitudes and conceptual understanding [3]. Third, the development of a novel concept of teching, allowing students to explore theoretical and experimentsal aspect of act of magnetism field on moving charge through real experiments and simulation[4] and the last one , The results of the CELS development study can improve student learning motivation for the cognitive realm [5]. CELS-based worksheets have been developed before, it's just not known whether their use is effective in minimizing misconceptions in Newton's law. Therefore it is necessary to conduct research to see the effectiveness of CELS-based worksheets in minimizing misconceptions in Newton's law. Based on this, researchers are interested in making research on minimizing misconceptions and increasing students' understanding of Physics concepts with a CELS-based worksheet.

2. Materials and methods

The research method used was a quasi-non-equivalent pretest-posttest design experiment. In this study, there are two classes, namely the experimental and control classes. In the experimental class, learning is given by using a CELS-based worksheet and the control class is given using the regular worksheet. In the initial stages, both control and experiment classes were given a pretest about understanding concepts in Newton's law, then learning was carried out in the control class with the usual worksheets and in the experimental class with the worksheet based on CELS. Until finally both classes were given a post-test problem to see the results of their influence. To see the large n gain, it is calculated by the value.
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$$n - gain = \frac{postest - pretest}{\max score - pretest} \quad (1)$$

To see the n-gain score rating categories

Table 1. N-gain score category

N-gain score	Category
g>0,7	High
0,3≤g≤0,7	Middle
g<0,3	Low

[6]

Table 2. Effectiveness category n-gain score

Persentase (%)	Category

< 40	Ineffective
40-55	Less effective
56-75	Effective enough
>76	Effective

[6]

3. Result and discussion

Understanding of the concept in several aspects, namely interpreting, exemplifying, comparing. Classifying, explaining and concluding. The following results from the aspects of understanding concepts in the control class and experiments.

Table 3. Pretes, postes dan N-gain control results

Understanding aspects of the concept in the control class	Pretest	Postest	N-gain
Interpreting	26,67	64,32	0,25 (Low)
Exemplifies	35,4	52,34	0,21 (Low)
Combining	44,56	32,46	0,13 (Low)
Classifying	23,14	65,12	0,15 (Low)
Explaining	26,78	64,37	0,27 (Low)
Conclude	53,17	72,13	0,29 (Low)

Table 4. Pretes,postes dan N-gain Exsperiment Results

Understanding aspects of the concept in the control class	Pretest	Postest	N-gain
Interpreting	36,65	72,34	0,37 (middle)
Exemplifies	25,72	64,32	0,42 (middle)
Combining	34,74	73,84	0,53 (middle)
Classifying	52,14	62,46	0,32 (middle)
Explaining	55,62	75,34	0,57 (middle)
Conclude	24,78	74,37	0,62 (middle)

Based on the results of the above data, it can be concluded that the average n-gain value in the aspect of concept understanding for the control class is in a low category and the experimental class is in the medium category. After that the effectiveness of CELS-based worksheet based on SPSS 21 can be seen, the following results are obtained.

Table 5. Results of the analysis of the effectiveness of CELS-based worksheet

	Kelas	**Descriptives**		Statistic	Std. Error
Ngain_persen	Eksperimen	Mean		65.7137	2.03848
		95% Confidence Interval for Mean	Lower Bound	61.4471	
			Upper Bound	69.9803	
		5% Trimmed Mean		65.9165	
		Median		65.1515	
		Variance		83.108	
		Std. Deviation		9.11638	
		Minimum		50.00	
		Maximum		77.78	

	Range		27.78	
	Interquartile Range		14.87	
	Skewness		-.188	.512
	Kurtosis		-1.061	.992
	Mean		37.9659	2.66027
	95% Confidence Interval for	Lower Bound	32.3979	
	Mean	Upper Bound	43.5339	
	5% Trimmed Mean		38.4806	
Kontrol	Median		40.0000	
	Variance		141.541	
	Std. Deviation		11.89710	
	Minimum		11.11	
	Maximum		55.56	
	Range		44.44	
	Interquartile Range		12.12	
	Skewness		-.638	.512
	Kurtosis		-.036	.992

Tabel 6. Results of analysis of n-gain understanding concepts

Indicator of understanding concepts	Groups	Pretest	Postest	N-gain	Category	Mean (Effective)
Interpreting	Experiment	36,65	72,34	0,37	Middle	Experiment = 66
	Control	26,67	53,17	0,25	Low	(Effective Enough)
Exemplifying	Experiment	25,72	64,32	0,42	Middle	
	Control	35,42	75,62	0,21	Low	
Combining	Experiment	34,74	52,34	0,53	Middle	Control = 34 (Effectiveless)
	Control	44,56	73,84	0,13	Low	
Classifying	Experiment	52,14	32,46	0,32	Middle	
	Control	23,14	62,46	0,15	Low	
Explaining	Experiment	55,62	65,12	0,57	Middle	
	Control	34,55	75,34	0,27	Low	
Conclude	Experiment	24,78	64,37	0,62	Middle	
	Control	26,78	76,84	0,29	Low	

4. Conclusions

Based on the results of the study found that learning by using CELS-based worksheets is effective enough to minimize misconceptions in Newton's law.

Acknowledgement

Thank to Universitas Muhammadiyah Tapanuli Selatan for providing research funding through the Hibah Internal APB UM-Tapsel 2018 so that this research can be carried out.

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