Meta-analysis of Using Handouts to Enhance Chemistry Student's Learning Outcomes

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Article history	Abstract
	This article was written to report the well-prepared steps and their results of how the above mentioned concept was released. The method used is a meta-analysis method by comparing several similar articles to know the scientific effect of using them. The data collection technique used non-test, by browsing articles with Research Gate, Science Direct and DOAJ. Based on the result of the analysis, it was found that handouts can improve student learning outcomes. Comparison of student learning outcomes was observed from the percentage before and after using the handouts. Data analyzed used statistical test type paired sample. Based on the results of the analysis test from six studies on handouts, it was found that a significant increase in learning outcomes was 37,50%. These results indicate that the use of handouts can be used to support chemistry learning.

1. INTRODUCTION

Chemistry is a science subject that has high complexity and it's subject matter consist of three levels of representation, namely macroscopic, symbolic and sub microscopic dimensions. Therefore it is important that students master these concepts and the levels of representation because those concept are related to each other (Langitasari, 2016). Achievement of competencies in the learning process is highly dependent on the teaching materials used. They are all forms of material, both written or physical which are prepared by the teacher to support classroom learning. In compiling teaching materials, it is necessary to make student's characteristics a reference for designing learning (Budiningsih, 2015).

The teacher as a facilitator must adapt the substance, character, and insight that students have with teaching materials they used. Learning media consists of three forms, namely print-based media, electronic media and digital media (Wahidin, 2018). In this case, the teacher must design and determine the proper materials, so that they can encourage students to understand the concept or materials being studied more ease (Astari, 2018). One of the appropriate media to use when learning is handouts. Handouts are print-based media that contain summaries or parts of learning that are considered important so that students gain learning experiences through the sense of sight. At the end of each review, questions are asked to find out whether student's understanding the material, and also to determine their readiness to implement the handouts-scientific concept

(Korniawati, Kusumo & Susiloningsih, 2016). Handouts are also used as teaching materials for teachers in preparing lesson (Siti, Audina, Kokasih & Respatih, 2018; Rahmayani, Hindun & Hudha, 2015; Aini & Masykur, 2018; Bhabiet, Accraf, Khery, Kimia, Mataram & No, 2018; Salfrika, 2016).

Developing effective and attractive handouts is very important. There are many ways to develop them by paying attention to aspects such as content, structure, writing procedures and language styles. In addition, handouts must contain illustrations or images that can direct student's activities to become more active (Noorhidawati & Gibb, 2008; Alsadoon, 2020; Fatma, Holiwarni & Susilawati, 2016; Dwikristanto & Listiani, 2018; An, Rochintaniawati, & Fitriani, 2015). These aspects are also used as indicators to determine handouts are appropriate as a learning resource. Handouts can be suitable if they get a positive response after being tested on a limited basis in the classroom from both teachers and students (Habibati, Nazar & Septiani, 2019; Haritsah Ulya, Ratu Betta Rudibyani, 2019; Sistyarini & Nurtjahyani, 2017; Parsudi, Lukman & Kartika, 2017; Sumiati, Arcana & Taufiq, 2019).

Handouts play a role in improving language skills (Rokhimah, Fatmaryanti & Nurhidayati, 2018; Irfandi, Linda & Erviyenni, 2018 ; Pratama & Sakti, 2020; Haristah, Azka, Setyawati & Albab, 2019; Eliza, 2020; A. Agung, Ekayana, Tinggi & Komputer, 2020). In this case the handouts are used as a learning resource to prepare materials for the class discussion process. The availability of material or discussion will facilitate student's language skills and self-efficacy involved in the discussion process (Zuhri, 2014). The use of handouts is to be able to solve problems and understand the close relationship with real-life learning to solve problems. This will direct students to develop their thinking skills and high-level cognitive processes such as critical thinking skills, scientific literacy and science processing skills (Saraswaty, Masykuri & Mulyani, 2019; Rofiah, Aminah & Sunarno, 2018; Suparmi, 2019; Purwo, 2016; Zohrani, 2018; Ahmadi & Khery, 2013). Handouts have benefit as a learning alternative to improve the comprehensive intelligence of students, which includes knowledge, skills and attitude (Wati, 2017; Septryanesti, 2019; Nugroho, Ahmad & Rohman, 2019; Arimadona & Silvina, 2019; Novitasari, Masykuri & Aminah, 2016; Abdurrahman, 2020; Liniswanti, 2015). In addition, handouts are used to optimize the concepts of students in the learning process (Wisnu, Wijaya, Fajar, Tukad, Ix & Selatan, 2020; Plangsorn, 2017; Erba, 2020; Astuti, Saputro & Mulyani, 2016; Situmorang, 2013; Wang, 2018; Herwati, 2016; Muriati, 2014; Dumitrescu, Olteanu, Gorghiu, & Gorghiu, 2015; Anggela & Darvina, 2013). Optimal learning can be observed from student's significant learning achievement (Meerah, 2019; Nursafitri, Widaryanto & Zubaidi, 2020; Darma, Putra, Maulina & Pohan, 2018; Nazar, 2018; Prastyaningrum & Imansari, 2016; Silfi, Syakbaniah & Kamus, 2014).

A review of several articles, compiled as a review article by comparing the percentage of handouts use on student's learning outcomes. Based on the explanation above, the research question in this article "What is the effect of using handouts to support chemistry learning on improving student learning outcomes?"

2. METHOD

The method used is Meta-analysis which is a method carried out by collecting, reviewing and analyzing the research data (Anugraheni, 2018). The data collected in this review article was carried out online using Research Gate, Science Direct, and DOAJ search engine to search for relevant research articles. The search for relevant research articles was carried out using handouts, learning outcomes, and chemistry keywords.

From the data search, articles that met the criteria for comparing learning outcomes before and after reading them were chosen. Then the differences in learning outcomes were analyzed using paired sample statistical test and the resulting percentage was decided.

The result of handouts data tracing consisted in six articles which discuss the percentage in differences between before and after reading the handouts. Six articles were used as comparison, and the way to do it was using pretest and posttest percentages (Muliawati & Saputro, 2016; Sari, Kembaren & Sudrajat, 2018; Mawarni, 2015; Pujiastuti, 2018; Agustina, S & Mulyani, 2013; M. Agung, Cahyanto, Utomo & Yamtinah, 2016).

3. RESULT AND DISCUSSION

Handouts are teaching materials prepared by the teacher and can be used by students to develop their knowledge and insights. The discussion of handouts in this article was made to know the effect of using them to support chemistry learning outcomes. Handouts, as a learning resource presents a summarized material discuss in details.

The result analysis results were presented descriptively qualitatively and quantitatively. The percentage of results before and after the use of handouts can be observed in Table 1.

Table 1. Student Learning Outcomes

No	Percentage Of Learning Outcomes Increase (%)		
	Before Use Handouts	After Use Handouts	Enhancement
1	29,11	86,42	57,31
2	70,81	97,00	26,19
3	58,00	83,00	25,00
4	31,71	85,71	54,00
5	27,78	77,78	50,00
6	65,63	78,13	12,50
Average	47,17	84,67	37,50

Based on the analysis results, it is known that in table 1, student learning outcomes have increased in those. The average percentage before using the handouts was 47,17% and after using was 84.67%. The obtained results indicate an increase in learning outcomes by 37,50%. Using handouts, students were asked to test their understanding by doing posttest questions. Student's learning outcomes have increased because students read the material and finally understand the material being studied.

After using handouts, the improved learning outcomes percentage was analyzed using the paired sample statistical test and this can be observed in Table 2, 3, and 4.

Table 2. Paired Samples Statistics

		Mean	N	Std Deviation	Std Error Mean
Pair 1	Before Use Handouts	47.17 33	6	19.78918	8.07890
	After Use Handouts	84.67 33	6	7.05982	2.88216

Table 3. Paired Samples Correlations

		N	Correlation	Sig
Pair 1	Before Use Handouts & After Use Handouts	6	0.342	0.508

Table 2 shows the result of using handouts in chemistry learning from six articles. The average percentages before using the handouts is 47,17 and it increased 84,67. Whereas in Table 3, it showed the correlation value before and after using the handouts, it reached a correlation 0,34. Significant value was obtained, in $0,508 > \alpha$ (0,05) indicating that there was no correlation between before and after using the handouts.

Table 4. Paired Samples Test

Pair 1 Before Use handouts- After Use handouts	t	df	Sig. (2-tailed)
	-4.938	5	0.004

Table 4 shows the t value is -4,938, which is then used as hypothesis test. Hypothesis test can be concluded if H_0: there are no significant differences before and after using handouts to improve student's learning outcomes. H_1: There are significant differences before and after using handouts to improve student's learning outcomes.

After that the value of T table with t 0,975 and dk 5, the Obtained t count result was counted and dicided (-4,938) < T table (2,75). So H_0 is rejected, and H_1 is accepted. This means that which states that there are significant differences in learning outcomes obtained by students before and after using handouts as supporting chemistry learning. Based on the results of statistical data processing, it can be seen that the use of handouts as a support for learning chemistry can help improve student learning outcomes.

The increase in learning outcomes is influenced by the contribution of the teacher in regulating the learning and reading processes (individual learning). Handouts implementation is an individual learning approach introduced by piaget, who states that learning must be built through the cognitive structure of students. The teacher will lead students, while they are focusing on the learning material and also read the related handouts, as by so doing they will increase their understanding of the concept. This activity will also improve their way of doing the teacher's assignments (Rinaningsih, 2014). In addition, there are handouts to find out the initial abilities, interest and motivation of student during the teaching learning process in the class. This is in accordance with the research of Haji, Safriana & Safitri, 2015, with reveals that handouts can energize strength and good understanding. Good concepts earned by students can solve problems according to their abilities after reading the handouts.

Using Handouts in this article is to know whether it could enhance learning outcomes in tests given by the teacher at the end of a certain learning material. Teacher's tests can increase their cognitive process, so that their learning outcomes can also be enhanced. This premise is explained Irawati, 2014, which also adds that students with high cognitive process will be able to finish problems under standard concept, and solve problems more easily. According to Iza, 2018, explained that presenting learning material using handouts will enable students to construct a certain concept from one unit to another. So that this activity will give them more challenging and systematic experience.

4. CONCLUSION

Based on the articles discussed in this study, it can be concluded that the use of handouts to support chemistry learning can be taken into consideration, as this activity can become learning resources to be used as teaching materials. The learning outcomes showed a significant increase of 37,50%. These results indicate that use of handouts can be used to support chemistry learning of students.

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