The development and validation of science digital scrapbook in a universal design for learning environment

by Miranita Khusniati

Submission date: 08-Jun-2023 01:52PM (UTC+0700)
Submission ID: 2111589911
File name: 17._The_Development_And_Validation_Of_Science.pdf (514.54K)
Word count: 2510
Character count: 13608

Journal of Physics: Conference Series

PAPER · OPEN ACCESS

The development and validation of science digital scrapbook in a universal design for learning environment

To cite this article: I U Wusqo *et al* 2021 *J. Phys.: Conf. Ser.* **1918** 052090

View the article online for updates and enhancements.

The Electrochemical Society
Advancing solid state & electrochemical science & technology

The ECS is seeking candidates to serve as the
Founding Editor-in-Chief (EIC) of ECS Sensors Plus,
a journal in the process of being launched in 2021

The goal of ECS Sensors Plus, as a one-stop shop journal for sensors, is to advance the fundamental science and understanding of sensors and detection technologies for efficient monitoring and control of industrial processes and the environment, and improving quality of life and human health.

Nomination submission begins: May 18, 2021

This content was downloaded from IP address 103.23.103.196 on 17/06/2021 at 08:14

The development and validation of science digital scrapbook in a universal design for learning environment

I U Wusqo*[1], S D Pamelasari[1], M Khusniati[1], A Yanitama[1] and F R Pratidina[2]

[1] Science Education Study Program, Department of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Indonesia

[2]SMP 9 Salatiga, Salatiga, Indonesia

*Corresponding author: urwatin@mail.unnes.ac.id

Abstract. Traditional learning materials are dominating the pattern of lectures at science teaching and learning. This strategy is not optimal to empower slow learners. This research aims to develop and validate digital scrapbooks based on the universal design for learning (UDL). This is a research and development (R & D) using the 4-D model by Thiagarajan. The data collection and analysis method used in the early stage was the questionnaire method to obtain expert validation data. All data were analyzed descriptively. Furthermore, the data were gathered using the documentation method to obtain videos, images, and sounds as well as questionnaires to obtain expert assessments of science teaching materials contained in the UDL-based science digital scrapbooking. This article reports the development and validation of the UDL-based science digital scrapbook. The research results showed that this teaching media is valid.

1. Introduction

Semarang City has organized inclusive education starting in the 2018-2019 school year [1]. However, one of the identified obstacles is the absence of a special guidebook or module for disabled students and learning tools for inclusive schools [2]. It is one of the reasons for students with special needs to get less content in learning biology, chemistry, and physics [3]. As a result, 45% of students with special needs in science class do not understand the concepts being learned. The slow learner is one type of disability that many people face [4] in Semarang, amounting to 55 out of 73 students with special needs. They do not fond of reading long sentences, yet are easier to understand pictures and simple instructions [5]. Therefore, slow learners need curriculum modification [4], in this case, teaching materials that contain interesting, lucid pictures and simple language [6].

The required characteristics can be found in science digital scrapbooks which contain videos, photos, and audio of science concepts as well as narrative chapters discussed in visual images. According to [7] and [8] complex information presented in a visual form is easier to understand. Learning science in inclusive schools requires universal design for learning principles as there are regular and special needs students in these schools. So far, there has been no digital science scrapbook with the principles of Universal Design for Learning (UDL) that is used for children with special needs. For that reason, this study aims to determine the feasibility of a UDL-based digital scrapbook science.

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

2. Methods

This developmental study adopted the 4-D (four-D Model) by Thiagarajan. The model includes four stages, namely definition, design, development, and dissemination. During the first stage, definition, curriculum analysis, student analysis, basic competency analysis, concept analysis, and learning objective determination were carried out. The second stage is the design phase which aims to create a media product in the form of a digital science scrapbook based on the universal design for learning. The result at the design stage was referred to as draft I. In addition to learning media, it also prepared validation tools for experts including material experts and media experts. Further, the third stage, development, aims to find out and evaluate the product through validation tests by the experts.

During the validation process in the development stage, the experts filled out the validation sheet and provided suggestions and criticisms for draft I. Suggestions and criticisms proposed by the validators were taken into account to improve the developed learning media prior to the trial. The revised version was called draft II. The validation result data were analyzed using quantitative descriptive analysis by calculating the average score given by the validators. The validation instrument of the UDL-based Science Digital Scrapbook was in the form of a Likert scale. It covered the aspects of assessment for material and media experts. The assessment scores obtained were then analyzed using the following formula:

$$P = \frac{f}{n} x\ 100\%$$

Information :

P : The percentage of obtained score
f : The total score
n : Maximum score

$$\text{The highest score (\%)} = \frac{the\ highest\ score}{maximum\ score} x\ 100\% = = \frac{4x14}{4x14} x\ 100\% = 100\%$$

$$\text{The lowest score (\%)} = \frac{the\ lowest\ score}{maximum\ score} x\ 100\% = = \frac{1x14}{4x14} x\ 100\% = 25\%$$

$$\text{Class interval (\%)} = \frac{\%\ the\ highest\ score - \%\ the\ lowest\ score}{4} x\ 100\% = \frac{100\%-25\%}{4} x\ 100\% = 18{,}75\%$$

The percentage score results were then converted into the validation assessment criteria as in the following Table 1 [9] :

Table 1. Validation Assessment Criteria

Percentage	Criteria
81,25% < score≤ 100%	Highly Valid
62,50% < score≤ 81,25%	Valid
43,75% < score≤ 62,50%	Fairly Valid
25,00% < score≤ 43,75%	Less Valid

Based on Table 1, the UDL-based Science Digital Scrapbook is declared valid if the percentage obtained is > 62.50%.

3. Results and Discussion

3.1. The Validation Results by Material and Media Experts

The validity of the UDL-based Science Digital Scrapbook was determined based on the media validation results. There were three media experts and three material experts serving as the validators in this study. They are lecturers of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, and science teachers who teach in an inclusive school. The validation results are presented in Table 2 and Table 3 as follows:

Table 2. The Validation Result Percentage of UDL-based Science Digital Scrapbook by the Media Experts

No	Media Expert	Affiliation	Percentage (%)	Criteria
1	AM-1	Lecturer of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang	85,42	Highly valid
2	AM-2	Lecturer of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang	93,75	Highly valid
3	AM-3	Science teacher of an inclusive school	89,58	Highly valid
		Average	89,58	Highly valid

Table 3. The Validation Result Percentage of UDL-based Science Digital Scrapbook by the Material Experts

No	Media Expert	Affiliation	Percentage (%)	Criteria
1	AM-1	Lecturer of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang	95,00	Highly valid
2	AM-2	Lecturer of Integrated Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang	95,00	Highly valid
3	AM-3	Science teacher of an inclusive school	92,50	Highly valid
		Average	94,17	Highly valid

Based on the validation results by media experts as displayed in Table 2, the validators scored 85.42%, 93.75%, and 89.58%. From there, the UDL-based Science Digital Scrapbook fell into the 'highly valid' category. Furthermore, each material expert scored 95.00%, 95.00%, and 92.50%, thus, the materials of UDL-based Science Digital Scrapbook were classified as 'highly valid'. Based on the expert assessment, the media is suitable for use in learning activities. Nevertheless, although it is highly valid, the experts suggested that the researchers provide clearer image/photo captions to assist students' understanding. Besides, a change of font type and size might be needed to make it easier for students to grasp information.

3.2. The Specification of UDL-Based Science Digital Scrapbook

The developed product, UDL-based science digital scrapbook, is adapted to the 2013 curriculum for junior high school. This product profile is in the form of a Scrapbook which emphasizes the appearance of images and is occupied by sufficient descriptions and notes as seen in Figure 1. The scrapbook does not only help students during the learning process, it can also be used by them to learn independently. The scrapbook that the researchers compiled includes a table of contents, indicators, materials that have been coherently arranged, pictures with explanations to make it easier for students, and last but not least, discussion sheets objecting to making students further develop the knowledge they have acquired after studying the materials presented in the scrapbook. In addition, the scrapbook learning media is also equipped with a manual, separated from the main part, that guides the students to use and maintain it [10]. This scrapbook was made using color schemes and images, hence, make it more effective for the readers in understanding the provided information [11]. Moreover, this scrapbook is arranged digitally, thus, the users are free to re-study the materials as it can be accessed anywhere. The digital scrapbook is a platform connected to a computer network, which can be made digitally, updated, stored, and shared [12] online via smartphones or other devices that can be used to explore the digital world [13] and connected to Google Drive facility. Therefore, the students are able to re-learn it without beating about the bush at anytime and anywhere.

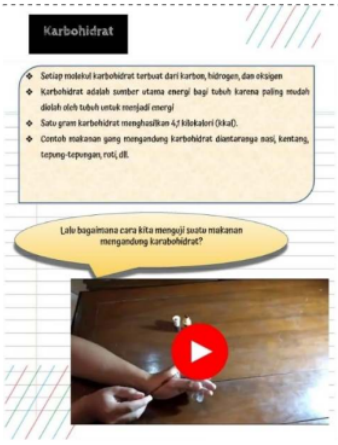

Figure 1. One of the Displays of UDL-Based Science Digital Scrapbook

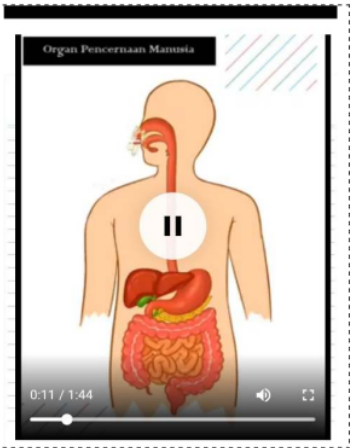

Figure 2. One of the videos contained in UDL-Based Science Digital Scrapbook

The development of the UDL-Based Science Digital Scrapbook is adjusted to the Basic Competencies of the 2013 Curriculum, which includes cognitive (KD 3.5) and psychomotor (KD 4.5). The established Science Digital Scrapbook is interactive digital teaching materials discussing the Digestive System topic for class VIII, odd semester. One peculiar characteristic of this media is the integration of Universal Design for Learning concepts which devotes learning for all profiles of students in an inclusive class by following 3 principles, namely representation, action and expression, and involvement [14].

The principle of representation refers to the design of teaching materials that make content accessible to students with a variety of backgrounds, perceptions, and characters. The UDL-Based Science Digital Scrapbook features images, audio and video, simple experiments, diagrams, and simple sentences. These are all available in digital form as in Figure 1 and Figure 2. This is in accordance with research adopting the principles of representation in UDL done by [14], [3], and [15] that employed videos, audios, symbols, video games, and printed-based texts. The results of the study indicated that the students found it easier to understand, access the materials, and can solve problems from the materials taught by the teacher. The student understanding of the materials was shown by an increase in the pre-test to post-test scores. The means of representation in the form of short videos with a duration of 30 to 90 seconds have supported students to be motivated in learning [16].

Action and Expression. This principle can be defined as an alternative method for students to communicate or show what they have learned. It includes guidelines for several means of physical action, expression, and communication as well as problem-solving functions that allow students to discover new concepts they did not know before [17]. Research by [3] and [15] explained the use of action and expression principles in the UDL-based learning design. During the classroom learning process, the teacher must compile teaching materials so that students also take action in solving the problems being studied. They are also allowed to carry out the learning procedure. For example, in learning to identify the nutritional content of foodstuffs, students learn indirectly study the materials by testing food ingredients in their home with a simple practicum. Slow learners are interested in videos containing practicum procedures since they usually find the written procedures which they

dislike. The outtakes showed the process of action and expression carried out resulted in students' better understanding of the learning.

The principle of involvement in the UDL-based Science Digital Scrapbook is seen from the media capability in providing instruction to students to perform a particular activity related to the materials being studied [18]. The activity includes simple practicums they could carry out at home, which makes it more interesting for them to complete. This kind of assignment lets the students to actively involve in the learning process such as writing, reading, and discussing [19]. Activities done in groups are equipped with discussion items so that learners cooperate with their respective teammates to complete the task. As in [3], these items are able to illustrate involvement in the UDL. In the established media, students are asked to calculate the molar mass available in the Mole Student Workbook (MSW). This principle enables students to lively participate in the learning process to enhance their comprehension of the materials.

4. Conclusion

The UDL-based Science Digital Scrapbook is feasible to use as a learning media, mainly for slow learners. Further, this media will be applied in inclusive schools' science learning to reveal its effectiveness.

Acknowledgement

We would like to say thank you to Universitas Negeri Semarang. Result of this research is part of the National Strategic Research funded through Daftar Isian Pelaksanaan Anggaran (DIPA), Universitas Negeri Semarang with contract number No. SP DIPA-023.17.2.677507/2020.

References

[1] Permatasari S and Manar D G 2019 *J. Politic Gov. Stud.* **8** 301
[2] Sari E Y 2017 *J. Pendidik. Pembelajaran Anak Sekol. Dasar* **3** 29
[3] King-Sears P 2014 *Learn. Disabil. Q.* **37** 68
[4] Rofiah N H and Rofiana I 2017 *Nat.c: J. Kaji. Penelit. Pendidik. Pembelajaran* **2** 94
[5] Nugrahayati W and Mustadi A 2019 *Slow Learner Learning Facts in Their Inclusion Class*. (In 6th International Conference on Educational Research and Innovation (ICERI 2018): Atlantis Press)
[6] Permatasari I, Pramudya I, and Kusmayadi T A 2018 *J. Phys.: Conf. Ser.* **983** 012095
[7] PB S N 2017 *Elem. Sch. Educ. J.* **1** 48
[8] Rodríguez-Estrada F C and Davis LS 2015 *Sci. Commun.* **37** 140
[9] Arikunto S 2012 *Dasar-Dasar Evaluasi Pendidikan Edisi 2* (Jakarta: Bumi Aksara)
[10] Susliana D and Wahyuni S 2019 *UPEJ Unnes Phys. Educ. J.* **8** 220
[11] Motegi R, Kanematsu Y, Tsuchida T, Mikami K and Kondo K 2016 *J. Geom. Graph.* **20** 115
[12] Kohut M 2011 *Art Ther.* **28** 123
[13] Solikin I and Amalia R 2019 *Sist.: J. Sist.Inf.* **8** 321
[14] Barteaux S 2014 *BU J. Grad. Stud. Educ.n* **6** 50
[15] Marino M T, Gotch C M, Israel M, Vasquez III E, Basham J D and Becht K 2014 *Learn. Disabil. Q.* **37** 87
[16] Zydney J M and Hasselbring T S 2014 *Tech. Trends.* **58** 21
[17] Abell M M, Jung E and Taylor M 2011 *Learn. Environ. Res.* **14** 171
[18] Ivanandewi SA, Utami B S and Pratiwi P 2019 *J. Kesehat. Kusuma Husada* 77
[19] Sukmawati P D, Tantra D K and Mahayanti N W S 2018 *J. Pendidik. Bhs. Ingg. Undiksha* **5** 1

The development and validation of science digital scrapbook in a universal design for learning environment

ORIGINALITY REPORT

11%	10%	5%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	"Solid (physics)", Salem Press Encyclopedia of Science, 2023 Publication	2%
2	www.jurnal.unsyiah.ac.id Internet Source	1%
3	nlist.inflibnet.ac.in Internet Source	1%
4	Isna Wardiah, Rahimi Fitri, Reza Fauzan, Saberan, Fuad Sholihin. "Android-based Matrix Learning Media to Increase Student Interest in Learning", 2022 Seventh International Conference on Informatics and Computing (ICIC), 2022 Publication	1%
5	mafiadoc.com Internet Source	1%
6	garuda.ristekbrin.go.id Internet Source	1%
7	sodas.ugdome.lt	

	Internet Source	1%
8	www.jurnal.albidayah.id Internet Source	1%
9	jppipa.unram.ac.id Internet Source	<1%
10	businessdocbox.com Internet Source	<1%
11	download.atlantis-press.com Internet Source	<1%

Exclude quotes	On	Exclude matches	< 5 words
Exclude bibliography	On		

The development and validation of science digital scrapbook in a universal design for learning environment

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6