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The Effectiveness of Universal Design for Learning

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Abstract

Each class has always consisted of students who have diverse characteristics and capabilities, and teachers have a responsibility to teach all the students in their class without exception. The teachers need a practical teaching approach to overcome such diversity. UDL is an approach designing in learning activities which are appropriate and effective for all students to use three underlying principles. This study aims to conduct a meta-analysis related to the useful application of UDL, in improving the quality of student learning based on twelve previous studies published in the journal. The results of the meta-analysis showed that the application of the principles of UDL could improve the quality of learners' learning process.

Keywords: Universal design for learning, Student diversity, Meta-analysis

1. Introduction

Students have diverse characteristics, it might be seen from the difference in the capacity of intelligence, physical condition, senses, social status, ethnicity, culture, and gender (Ormrod, 2008). Aspects of these differences affect students' academic success. Azwar (2014) describes the academic success of students is influenced by internal factors such as the functions of the

senses, physical health, interests, motivation, personality, talent and intelligence.

The external factors such as a condition of the place or a learning environment, infrastructure and learning materials. Learning materials will supported social and cultural influences. Each class has always consisted of students who have diverse characteristics (Rao & Meo, 2016), and teachers have a responsibility to teach all students who are in a class without exception. The characteristics divercity and conditions of learners in a classroom requires teachers to be able to design adequate learning activities and may accommodate the learning needs for all students. The inability of teachers in designing learning activities which is useful for all learners resulted in only some students who may succeed in understanding the lessons in a classroom.

This case prompted scientists to research to find a strategy to cope with such diverse student conditions. In the early 1990s, David H. Rose from the Harvard Graduate School of Education and colleagues at the Center for Applied Special Technology (CAST) devised an approach to design learning activities which may accommodate the learning needs for all students. The approach was given the name of Universal Design for Learning (UDL).

UDL was developed based on research in the field of education and neuroscience, as well as the growing influence of digital technology (Mayer, Rose, & Gordon, 2014). While the term universal design for learning was adapted from universal design (UD) in the field of architecture, which was declared by Ron Mace at North Carolina State University. Universal Design (UD) in the field of architecture is defined as an approach to designing buildings that might be accessed by many people, including people with disabilities. In other words, UD aims to remove obstacles for someone to access the surrounding environment. Examples of universal design (UD) in the field of architecture is to create a sloping road or provide a lift for wheelchair users, making access for the visually impaired, provide directions or path for the hearing impaired.

Based on UD in the field of architecture, the term of UDL is formed. UDL is defined as an approach to design appropriate learning activities and effective for all students (Mayer et al., 2014). Nelson (2014) describes the UDL as a framework that can assist educators in designing learning activities that freeway for all students. UDL consists of three principles which were developed based on cognitive neuroscience research and the learning process, and the third principle is to provide multiple means of representation, action and expression, also engagement (Mayer et al., 2014).

The first principle that provide multiple means of representation is to provide various means of representation to the students in acquiring, processing, and integrating information and knowledge (Mayer et al., 2014). The underlying assumption of this principle is different learners on how to understand and perceive the information given to them. Some students may find it easier to understand the information which presented in the form of images or sounds rather than information that presented in written form. Differences were found in the student may due to the barriers to hearing, vision, language, culture, and inability to learn. Thus, there are not an optimal means of representation for all students, it provides the option of representation be essential in learning activities (CAST, 2014).

The second principle that provide multiple means of action and expression is to providing a wide range of teaching strategies appropriate to the needs of students and provide a variety of options for students to express what they are already familiar from learning activities (Hall, Mayer, & Rose, 2012). This principle assumes that learners differ in their ability to access the learning environment and reveal what they know. Some students should have to express what they know through writing, but not being able to pronounce it, or vice versa. Such differences can be due to individuals who have limited physical function or movement disorders, individuals with impaired executive function, individuals who have barriers in language, and individuals who have a very different approach to learning. No actions and expressions that will be optimal for all learners, thus providing options for action and expression are significant (CAST, 2014).

The third principle, provide multiple means of engagement be providing a wide range of choice to support and raise student motivation (Hall et al., 2012). Mayer et al. (2014) explain this principle encourages teachers to keep students interested and motivated to learn. The underlying assumption of this principle is learners who have a difference, they can be engaged or motivated to learn. There are a wide variety of sources that may affect learners' affective conditions, such as neurological aspects, cultural, personal relevance, subjectivity, and knowledge background. Some learners are very interested in new things and spontaneous, but others do not like new things and tend to be afraid, some are more like routine. There are also learners who prefer to work alone, but there are also people who loved working in groups. There is nothing that can motivate or improve the involvement of all learners, so that provides various options to motivate and increase the interest of students is essential (CAST, 2014).

Based on the three principles, UDL has developed guidelines in designing learning activities mentioned by UDL guidelines (Hall et al., 2012). UDL guidelines consist of nine guidelines, and thirty-three checkpoints. UDL guidelines can help teachers in designing flexible learning by providing a variety of ways to access the lessons, a wide variety of ways to express what they have learned, and various ways to encourage and increase student motivation (Mayer et al., 2014). UDL is used as an approach in designing learning activities are universal, universal curriculum, and assessment that is universal, so that all students have the same opportunity to actively participate in learning activities. With the teacher becomes more alarming UDL background, preferences, abilities, and needs of the students they teach, so that teachers can ensure that the lessons they teach can be understood and attract the attention of all students (Rao & Meo, 2016). UDL does not mean “one size fits all,” UDL means all students with their characteristics have equal and fair access, as well as having the opportunity to learn the same material by working the best and most effective for them (Hall et al., 2012). Also, the UDL is not only needed by teachers in schools run an inclusive education system, but teachers in public schools or regular are also needed because UDL includes education for all students and not just discuss the diversity of students on aspects of disability alone. However, discusses the diversity of students from a broader aspect, such as differences in social status, culture, learning styles, interests, and motivations (Hall et al., 2012).

UDL has begun to be used in developed countries, such as America, Canada, Australia, and other developed countries. While in Indonesia UDL still many who do not know, and only began to be introduced in 2015 at the University of Gadjah Mada, the University of Yogyakarta through seminars and workshops. Before UDL applied in Indonesia, it would require a meta-analysis of studies related to the effectiveness of UDL in improving the quality of students' learning process. This article aims to review the effectiveness of the implementation UDL results of the study, published in the journal. With the results of the review of the effectiveness of UDL, is expected to educators, education professionals, and researchers in the field of education in Indonesia can recognize and start using the UDL as a solution to improve the academic success of all students.

2. Methodology

Journal search is done by using the keywords “Universal Design for Learning.” Criteria used journal is a journal which explicitly writes the word Universal Design for Learning (UDL) in the title or abstract or the contents of the article. Journal used the following criteria: 1) published between the years 2013 to 2017. 2) journals are peer-reviewed journals in order to ensure quality. 3) Journal of measurement study pre and post implementation of UDL, because the purpose of this article is to look at the effectiveness of the implementation of UDL. 4) UDL applied at all levels of education from primary school to university because UDL aims to improve the quality of learning among all students. Based on these criteria found 12 journals that meet the criteria.

2. Results

Based on the analysis of 12 journals, note that the implementation of UDL can enhance the entire learning process of learners. From the twelve journals, there are four quantitative research examining the relationship between the implementation of UDL with increased learning (Davies, Schelly, & Spooner, 2013; Knight, Spooner, Browder, Smith, & Wood, 2013; Navarro, Zervas, Gesa, & Sampson, 2016; Tzivinikou, 2014), and a quantitative study that addresses learning outcomes after the application of UDL (Mavrou, Charalampous, & Michaelides, 2013). Research Knight et al. (2013) found an increase in the process of learning when teachers use visual media to teach science to students with autistic spectrum disorder (ASD) and intellectual disabilities (ID).

Research Mavrou et al. (2013) found that the ability to speak and make inquiries on students who are taught by using symbols and pictures media increased, and more developed than students who only taught with verbal methods. Davies et al. (2013) found that presenting subject matter in various ways in psychology courses at the university can increase student interest in learning and broaden students' access to explore lecture material. Research results by Tzivinikou (2014) also showed that the use of UDL in the first year of college teaching, with a focus on perception, language and symbols, and understanding, resulting in prospective teachers be able to develop a learning plan that is more inclusive and improve learning in all students.

Navarro et al. (2016) found that undergraduate students of teacher training on using the UDL

principles and guidelines resulted in changes to the planning of learning activities relating to the representation, action and expression, and interest. Based on the results of quantitative research can be concluded that an increase in the process of learning in all students when the principles, guidelines, and checkpoints UDL implemented.

From the 12th to be reviewed journal, there is a qualitative study involving pre and post-test, namely research Kumar and Widerman (2014). Kumar and Widerman (2014) investigated the use of UDL principles in the college of nursing; the research results show that an increase in the learning process through the reduction of stress on students, and increase student confidence.

From the 12th journals reviewed, six studies were using mixed methods. The six studies that use mixed methods, there are five research (Hall, Cohen, Vue, & Ganley, 2015; He, 2014; Katz, 2013, 2015; Marino et al., 2014) (Hall, Cohen, Vue, and Ganley, 2015; He, 2014; Katz, 2013, 2015; Marino et al., 2014), which examines the relationship between the implementation of UDL with an increase in the learning process, and one study (Hitchcock, Rao, Chang, & Yuen, 2016) (Hitchcock, Rao, Chang, & Yuen, 2016) who focus on educational outcomes. Three studies are using the Three Block Model of UDL. Katz (2013, 2015) found that three block models (TBM) of UDL can increase academic engagement, social engagement, student engagement, intellectual engagement, and interaction in the classroom. Research by Marino et al. (2014) identified that an increased enthusiasm and willingness to learn on all students during the teacher uses multiple means of representation principle when teaching natural science subjects. Hitchcock et al. (2016) identify improvements in scientific writings as a multimedia technology used in the writing intervention programs on natural science subjects. Besides, the research results Hitchcock et al. (2016) also showed increased support for the development of targeted literacy, collaboration, and reflection. Hall et al. (2015) explained that using online reading strategies can improve the reading process for all students.

He (2014) concluded that using UDL principles in online lectures for undergraduate and postgraduate students can influence their self-confidence in learning, confidence in teaching online, and increasing participant self-efficacy. Additional benefits identified in these six studies were flexibility, variation in learning material, increased collaboration, improved teacher and student relationships, increased access to subject matter through effective and sustainable technology, learning and teaching, and increased reading skills. A summary of 12 studies above could be seen in Table 1.

Table 1. UDL effectiveness research from 2013 to 2016

Authors	Participants	Application of UDL	Results
Davies, Schelly & Spooner (2013)	Nine lecturers of psychology study programs (6 experimental groups,	Lecturer experimental group applying UDL principles when teaching	Improving students access to the course material. Increasing the

Authors	Participants	Application of UDL	Results
	and three control groups). Five hundred ninety students of psychology (386 intervention group and 204 control group).		student's interest is to engage in the learning process.
Mavrou, Charalampous, & Michaelides (2013)	40 kindergarten students (20 experimental group students and 20 control group students)	Teachers apply the principle of multiple means of representation using symbols and pictures to encourage the development of language skills of students in kindergarten.	Improve students' skills in speaking and responding when asked to communicate.
Katz (2013)	631 students in grade 1 to grade 12.	UDL principle applied in teaching practice.	Students become more interested in learning, willing to do the work, the interaction between the students become more increased, and more respect individual differences.
Knight, Spooner, Browder, Smith, & Wood (2013)	3 ASD students with intellectual disabilities in moderate to severe category.	The application of UDL principles in the teaching of natural science through pictures and words as a visual media form.	Students with ASD and intellectual disabilities become simpler to understand the lesson rather than when the teacher teaches only using textbooks.
He (2014)	Twenty-four prospective teacher students.	Application of UDL principles in online learning.	Participants become more confident in the study, more confident in online teaching, enhance self-efficacy in learning online, and

Authors	Participants	Application of UDL	Results
			students are satisfied with the course modules online.
Marino et al. (2014)	Three hundred ninety-eight high school students (341 regular students, and 57 students with learning difficulties), and 150 secondary school teachers.	Applying the principle of multiple means of representation by presenting material through video games and printed books alternatives to textbooks in teaching natural science subjects.	Students prefer to access learning through computers than books. Students feel more relaxed learning through video games. Students feel in learning activities become more real, and interesting, students' enthusiasm for learning increases.
Kumar & Wideman (2014)	50 first year of college nursing students.	UDL principle applied in the lectures.	Lecturers have positive teaching experience, reduce stress on students, improve student confidence and improve relations as between faculty and students.
Tzivinikou (2014)	69 first-year education student (60 regular students, nine students with learning disabilities)	UDL principle applied in teacher training programs with a focus on the application of multiple means of representation.	Participants become able to develop plan learning activities that can provide a wide range of choice of representation, action and expression, and various ways to engage all students actively engaged in learning activities.

Authors	Participants	Application of UDL	Results
Hall, Cohen, Vue, & Ganley (2015)	398 high school students (307 regular students, 91 students with disabilities	The application of multiple means of representation while providing the option for students to read course materials online and offline, and from various media.	Interest in reading students have increased, students can access lessons from various media and sources, and increase student engagement in learning activities.
Katz (2015)	Fifty-eight teachers grades 1 to 12, and 600 students from grades 1 to 12.	UDL principle applied in teaching practice.	Students become more interested in learning; peer interaction has increased, teaching becomes more effective.
Hitchcock, Rao, Chang, & Yuen (2016)	Fifty high school students (46 regular students and four students with special needs).	Applying the principle of representation, action, and expression. Teachers provide instruction to the multi-media technology in increasing interest in students to write scientific papers.	There was an increase in the writing of scientific papers when multimedia technology has used as a medium of learning in the program increased interest in writing scientific papers on the subjects of natural science.
Navarro, Zervas, Gesa, & Sampson (2016)	47 teachers.	Training in the lesson plan based on the principles of UDL.	Participants are better able to develop learning activities that contain the principle of representation, action, and expression, and increasing the interest of students to learn.

3. Discussion

Based on the results of a review of 12 research note that the implementation of the principles of UDL in learning activities to enhance the students' learning process. The following discusses of the effectiveness of any UDL principles. Firstly, the effectiveness of the principle of multiple means of representation. Multiple means of representation have the basic premise that there are various ways to represent knowledge to students.

Research by Marino et al. (2014) discusses the use of video games and books other than textbooks alternative to increasing the involvement and interest of students who have difficulties in learning at the secondary school level in the study of natural science subjects.

Results of research Marino et al. (2014) show that video games and printed materials other than textbooks are effective in providing a wide variety of ways of presenting and conveying knowledge to students. There is a level of involvement of students is higher when teachers provide a wide range of alternatives to represent the subject compared to when teachers are using teaching materials only from textbooks alone.

Research by Hall et al. (2015) tested the use of reading strategies online to support the development of literacy in middle school to students. Hall et al. (2015) provide a variety of ways for students to access reading materials that can enhance the experience of reading in students, including the search for reading material online from a computer. UDL would have directly applied to the digital-based learning environment that can support the results of reading in students.

Tzivinikou study (2014) focused on the implementation of multiple means of representation during the early years of the course, and the results of the research showed the students be able to apply the principles of UDL in designing lesson plans.

Second, the effectiveness of the principle of multiple means of action and expression. The basic assumption of this principle is that there are various ways to do the students to show what they are already familiar from the material being taught.

Research by Mavrou et al. (2013) which uses participants' children aged 3.5 to 5 years. In his research, children have given the option to use the words and/or symbols when they want to make the question verbally. Research results indicate that the use of symbols to give a positive influence on children's ability to make inquiries.

Research by Hitchcock et al. (2016) which uses TeenACE program showed an increase in the writing process on all students. The use of TeenACE software provides the opportunity for students to access and present information. Multimedia software supported by cognitive modeling, measures, and tools received. The steps and process of writing the software structure TeenACE give clear instructions and illustration skills based on process skills in writing. Also, the software TeenACE also gives us the option to listen to what they have written. The result is students enjoy the learning process by using technology, and students feel happy to be able to write in a way that is different and fun.

Third, the effectiveness of the principle of multiple means of engagement. The third principle

based on the assumption that teachers can become blind students actively participate in learning activities in various ways.

Katz's research results (2013, 2015) discussed the effect of three block models (TBM) of UDL on academic involvement and social involvement. UDL approach gives teachers a method to create an inclusive environment and increase student engagement. Results of research Katz (2015) showed that the application of the principles of UDL increase student engagement and interaction between students. Besides, the results of He (2104) showed that the online lecture by applying the principles of UDL could increase self-confidence and self-efficacy of students.

Research results of Navarro et al. (2016), which examines the influence of the learning plan development training using UDL principles in the student teacher showed an increase in the use of third UDL principles in designing learning activities. The same was found by Tzivinikou (2014) in his research that gives the material three UDL principles in professional teacher training program showed an increase in the third use UDL principles in the lesson plan. Based on two studies it was found that training on the principles of UDL increase the use of various ways of representing knowledge or information to learners, provide various ways for students to show what they are already familiar, and provides a variety of ways to increase the involvement of all students in activities learning.

4. Conclusion

Based on the analysis of 12 journals known that the application of the principles of UDL proven effective in improving the quality of learners' learning process. UDL should have applied in usual schools, and inclusive schools can be used to teach students from children to adults such as college students and might have used for a wide variety of characteristics and abilities of students. Strategies that might have done so that teachers can use UDL in their teaching activities is by providing training on the principles of UDL.

References

Azwar, S. (2014). *Pengantar psikoogi inteligensi*. Yogyakarta: Pustaka Pelajar.

CAST. (2014). The Three Principles of UDL. Retrieved July 1, 2018, from http://www.udlcenter.org/aboutudl/whatisudl/3principles

Davies, P. L., Schelly, C. L., & Spooner, C. L. (2013). Measuring the effectiveness of a universal design for learning intervention in postsecondary education. *Journal of Postsecondary Education and Disability, 26*(3), 195-220.

Hall, T. E., Cohen, N., Vue, G., & Ganley, P. (2015). Addressing learning disabilities with UDL and technology: a Strategic reader. *Learning Disability Quarterly, 38*(2), 72-83. https://doi.org/10.1177/0731948714544375

Hall, T. E., Mayer, A., & Rose, D. H. (2012). An Introduction to Universal Design for Learning: Questions and Answers. In T. E. Hall, A. Mayer, & D. H. Rose (Eds.), *Universal Design for Learning in the Classroom* (pp. 1-8). New York: Guilford.

He, Y. (2014). Universal design for learning in an online teacher education course: Enhancing learners' confidence to teach online. *MERLOT Journal of Online Learning and Teaching,*

10(2), 283-298.

Hitchcock, C. H., Rao, K., Chang, C. C., & L, Y. J. W. (2016). TeenACE for science: Using multimedia tools and scaffolds to Support writing. *Rural Special Education Quarterly, 35*(2), 10-23.

Katz, J. (2013). The three-block model of universal design for learning (UDL): Engaging students in inclusive education. *Canadian Journal of Education, 36*(1), 153-194.

Katz, J. (2015). Implementing the three-block model of universal design for learning: Effects on teachers' self-efficacy, stress, and job satisfaction in inclusive classrooms K-12. *International Journal of Inclusive Education, 19*(1-20), 37-41. https://doi.org/10.1080/13603116.2014.881569

Knight, V. F., Spooner, F., Browder, D. M., Smith, B. R., & Wood, C. L. (2013). Using systematic instruction and graphic organizers to teach science concepts to students with autism spectrum disorders and intellectual disability. *Focus on Autism and Other Developmental Disabilities, 28*(2), 115-126. https://doi.org/10.1177/1088357612475301

Kumar, K. L., & Wideman, M. (2014). Accessible by design: Applying UDL principles in the first year undergraduate course. *Canadian Journal of Higher Education, 44*(1), 125-147.

Marino, M. T., Gotch, C. M., Israel, M., Iii, E. V, Basham, J. D., & Becht, K. (2014). UDL in the middle school science classroom: Can video games and alternative text heighten engagement and learning for students with learning disabilities? *Learning Disability Quarterly 2014, 37*(2), 87-89. https://doi.org/10.1177/0731948713503963

Mavrou, K., Charalampous, E., & Michaelides, M. (2013). Graphic symbols for all: Using symbols in developing the ability of questioning in young children. *Journal of Assistive Technologies, 7*(1), 22-33. https://doi.org/10.1108/17549451311313192

Mayer, A., Rose, D. H., & Gordon, D. (2014). *Universal Design for Learning: Theory and Practice*. Wakefield: CAST Professional Publishing.

Navarro, S. B., Zervas, P., Gesa, R. F., & Sampson, D. G. (2016). Developing teachers' competencies for designing inclusive learning experiences. *Educational Technology & Society, 19*(1), 17-27.

Nelson, L. L. (2014). *Design and Deliver: Planning and Teaching Using Universal Design for Learning*. Baltimore: Paul H. Brookes Publishing.

Ormrod, J. E. (2008). *Psikologi pendidikan: Membantu siswa tumbuh dan berkembang* (6th ed.). Jakarta: Erlanngga.

Rao, K., & Meo, G. (2016). Using universal design for learning to design standards-based lessons. *SAGE Open, 6*(4), 1-12. https://doi.org/10.1177/2158244016680688

Tzivinikou, S. (2014). Universal design for learning - Application in higher education: A Greek paradigm. *Problems of Education in the 21st Century, 60*, 156-166.