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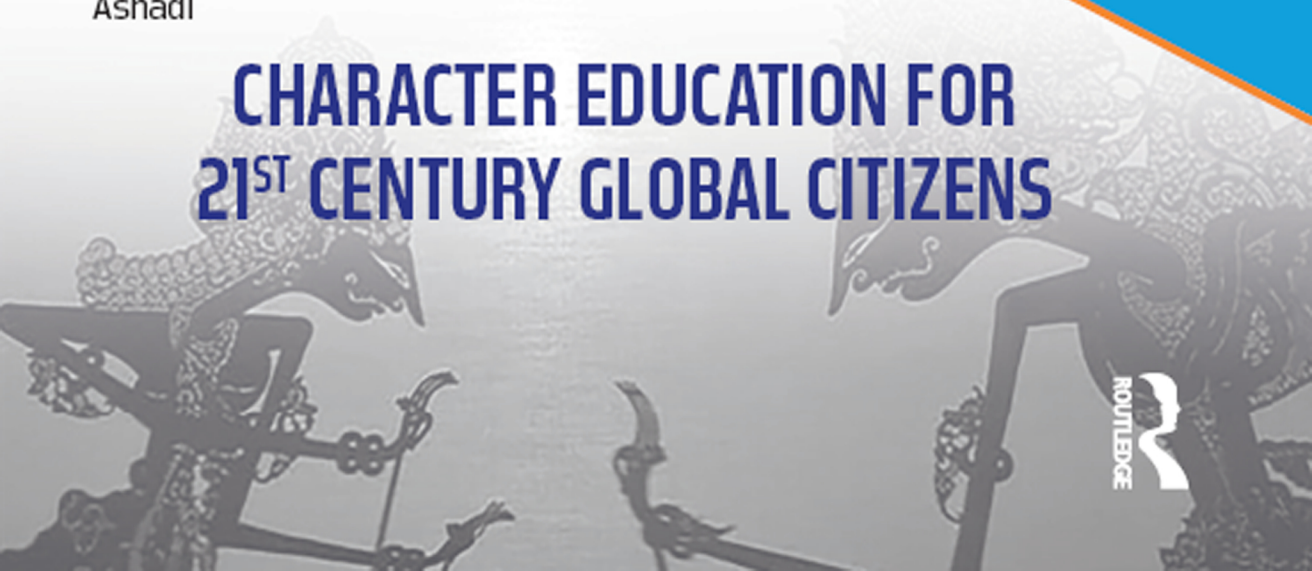
CHARACTER EDUCATION FOR 21ST CENTURY GLOBAL CITIZENS



ROUTLEDGE

CHARACTER EDUCATION FOR 21ST CENTURY GLOBAL CITIZENS

PROCEEDINGS OF THE 2ND INTERNATIONAL CONFERENCE ON TEACHER EDUCATION AND PROFESSIONAL DEVELOPMENT (INCOTEPD 2017), 21–22 OCTOBER 2017, YOGYAKARTA, INDONESIA

Character Education for 21st Century Global Citizens

Editors

Endah Retnowati, Anik Ghufron, Marzuki, Kasiyan, Adi Cilik Pierawan & Ashadi

Universitas Negeri Yogyakarta, Indonesia

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Preface

The 2nd International Conference on Teacher Education and Professional Development was held in Yogyakarta (Indonesia) on 21–22 October 2017. The conference is an annual event, conducted by Universitas Negeri Yogyakarta's Institute of Educational Development and Quality Assurance. Similar to the previous conference, this conference received enthusiastic response from scholars and practitioners particulcarly interested in character education. Participants from Australia, Japan, Malaysia, the Netherlands, and many cities in Indonesia attended this year's conference.

Exploring the theme "Character Education for 21st Century Global Citizens", the committee has invited Prof. dr. Ali Ghufron Mukti, M.Sc., Ph.D. (General Director of Higher Education and Human Resources from the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia) as a keynote speaker. Moreover, the committee has also invited Prof. Azyumardi Azra, Ph.D., Prof. Dr. Wiel Veugelers, Asst. Prof. Dr. Betania Kartika Muflih, Emeritus Prof. Dr. Terry Lovat, Prof. Dr. Kerry John Kennedy and Prof. Suyanto, Ph.D as invited speakers. Participants presented their papers, which are categorized under subthemes: 1) Values for 21st century global citizens, 2) Preparing teachers for integrative values education, 3) Teacher professional development for enhanced character education, 4) Curriculum/syllabus/lesson plan/learning materials development for integrated values education, 5) Developing learning activities/tasks/strategies for character education, 6) Assessing student's character development (values acquisition assessment), 7) Creating/managing conducive school culture to character education, and 8) Parents and public involvement in character education.

There were approximately 232 submissions from various countries to the conference. The committee selected 127 papers to be presented in this year's conference. The scientific committee has reviewed 117 papers that are qualified for publication. After a careful consideration, there are 83 papers (covering sub-themes 1 to 7) included in the proceeding of the conference that is published by CRC Press/Balkema and submitted for indexation to Thomson Reuters/Scopus.

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Values for 21st century global citizens

Character Education for 21st Century Global Citizens – Retnowati et al. (Eds)

The improvement of independent learning through the use of a virtual laboratory in chemistry hybrid learning

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ABSTRACT: Information and Communication Technology (ICT) can support the implementation of a virtual laboratory in chemistry hybrid learning (ViCH-Lab). The use of a ViCH-Lab on the topic of the hydrolysis of salt was studied, by which the improvement of the students' independent learning was measured and compared to that of students who did not use it. The virtual laboratory was developed in HTML format with animations. The ViCH-Lab mainly contained menus of learning materials, laboratory work topics, and evaluation. The method of research was a mixed method with embedded experimental design. The total number of samples were 68 students from class XI, consisting of 34 students in an experiment group and 34 students in a control group. The students in the experiment group learned chemistry through both regularly scheduled face-to-face sessions and teacher supervised online practices through the ViCH-Lab on a website, while those in the control group were only taught through regularly scheduled face-to-face sessions without the online component. The data regarding the improvement in the students' independence was collected at the beginning and at the end of the learning activities using a questionnaire, and during the process of learning using an observation checklist. The data was analyzed statistically by an independent sample t-test and descriptive analysis. The results showed that the improvement in students' independence in the experiment group was significantly higher than that of the control group.

1 INTRODUCTION

A teacher plays an important role in education. Beside teaching, they are also educators (Yuswono et al, 2014). They are required to create creative and innovative learning processes, facilitating students to be as active as the curriculum requires. Many learning processes were dominantly controlled by teachers in one-directional learning or teacher-centered learning. The observation of learning processes in some schools in Yogyakarta, Indonesia showed that some learning activities were still done through teacher-centered learning. Teacher-centered learning was closely related to the culture of Indonesia. Indonesian teachers, whose youngsters usually tend to follow older people's directions, should ensure that students are challenged and active in the learning process. According to Nugroho (2012), students should be active in learning activities, while teachers should be active in preparing learning packs, motivating students, and making the learning process more effective.

Chemistry learning materials are wide-ranging and comprehensive, consisting of macroscopic and microscopic concepts, which challenge students to find an appropriate learning strategy. Since chemistry is learned as a separate subject for the first time at senior high school level, many students find chemistry to be a difficult lesson as it contains intangible concepts. In fact, the concept must be built and constructed by students. For that reason, learning chemistry requires visualization. This visualization can be achieved through working in the chemistry laboratory. In the laboratory, students will be shown the phenomena of a chemical concept through the experiments that are conducted by the students themselves, from which they are expected to be able to build the concept on their own. One of the topics in chemistry that needs practice in the laboratory is salt hydrolysis. The topic is scheduled in

the 2nd semester of Year XI in senior high schools. Therefore, to learn about salt hydrolysis, practices in the lab or integration in the theory should be facilitated.

Based on the observations in a senior high school in Yogyakarta, Indonesia, students had a poor understanding of chemistry concepts. The students' learning difficulties might occur because there are too many concepts of chemistry, and they are intangible and systemically interconnected. It might also be due to having a limited time for learning and the poor preparation of the students. Other problems come from the fact that most laboratory activities might not completely support the theory studied in the classroom due to a lack of chemicals. As reported by Yennita et al. (2012), some problems could be faced when conducting practical chemistry lessons in Indonesian schools, such as the time available to provide laboratory work activities for students, the lack of equipment, and the ability of the teachers to design and develop inquiry learning for the needs of the students.

The development of digital technology is very rapid nowadays, which significantly affects most aspects of life, including education. Education in the digital age requires the integration of ICT into all subjects. To update the educational challenges in this digital age, teachers and students in the 21st century must be able to communicate and keep up with the times, including adjusting to the development of technology. The development of ICT is also supported by the progress of the internet network, which has been widely spread to most areas in Indonesia, even the remote areas. From the internet and ICT, a lot of information can be gained easily at any time and anywhere. The development of the internet network can result in a dramatic improvement in the sources of learning, including for chemistry. Therefore, students need to learn how to use technology in order to get the maximum impact from the learning process.

Based on the results of the study of technological advances and observations from the participating senior high school, SMA Negeri 4 Yogyakarta, it was necessary to develop a model of learning and the types of media that support internet-based learning in the classroom and in the laboratory, as well as to foster the learning interests that motivate students to improve their independence both inside and outside the classroom. Kurniawan and Zulkaida (2013) stated that interests had an effect on independent learning, so that students who have a high interest in learning further explore lessons independently. Based on the observation, SMA Negeri 4 Yoyakarta is a school that provides Wi-Fi connection facilities that are supposed to be used freely by the students. In addition, most students from the science group of Year XI in the SMA Negeri 4 Yogyakarta have their own laptops and smartphones. Wi-Fi, laptops, and smartphone facilities were the tools that would be useful to support another model of learning called hybrid learning.

The hybrid learning model is one of the learning models supported by technological development, by integrating innovation and technological advancement through online learning systems, providing interaction and requiring the participation of traditional learning models (Thorne, 2003). Husamah (2014) stated that the hybrid learning model can reduce face-to-face activities but it does not eliminate them, thus enabling students to learn by online methods. Through a hybrid learning based model, students are expected to be able to learn independently and sustainably. As a consequence, learning is going to be effective, efficient, and interesting. Computer technology for education can be utilized for learning media, such as Microsoft PowerPoint, Adobe Flash, Digital Comics, Construct 2, and other programs that can be used both in online and offline mode.

Kemp and Dayton stated that the use of instructional media could make learning interesting, interactive, effective, efficient, improved, and flexible (Susilana & Riyana, 2008). Moreover, the use of digital media was flexible, being used whenever and wherever necessary. One of the digital learning media that can be developed is a virtual chemistry laboratory (ViCH-Lab). Ikhsan and Hadi (2015) stated that the development of virtual lab media could be achieved using HTML5 programming language, which has many advantages. This study utilizes HTML5-based learning media, which was packaged in the form of a ViCH-Lab media and whose implementation was integrated in chemistry hybrid learning. The use of the media was integrated into an interesting learning model, which was one of the efforts used to improve the students' interests independently. Rahmawati (2015) stated that computer-based learning media supported the independent learning of students.

This research investigated the effect of the use of a ViCH-Lab on the students' independent learning of the topic of hydrolysis of salt, from which the improvement in independent learning of those students who used the ViCH-Lab in chemistry hybrid learning was measured and compared to that of the students who did not use the ViCH-Lab.

2 LITERATURE REVIEW

2.1 *Virtual laboratory*

A laboratory, as defined by Hornby (2010), is a room or building used for scientific research, experimentation, and testing. Woolnough and Allsop (1985) state that the activities of the laboratory are an integral part of learning activities, serving as a vehicle to raise the motivation to learn, develop basic skills to experiment, learn scientific approaches, and to support the subject matter. Dkeindek et al. (2012) state that the activity of the laboratory is a learning environment that establishes the concept of science to learners. Laboratory activities can be summarized as practical activities by learners that can be done either directly in the classroom or field, or indirectly by using a virtual laboratory simulation using a computer device.

The concept of the virtual laboratory, according to Harms (2000), can be divided into two main concepts: (1) trials were replaced with computer models, in the form of a simulation that represented the real laboratory experiments as closely as possible, in the form of a so-called virtual laboratory; (2) it can be called a virtual laboratory experiment when the experiment is controlled through a computer, which is connected to the actual laboratory equipment through a network called a remote lab. A virtual laboratory is a supporting motivational factor for reproducing the experiment and developing the skills of the learners in the trials (Dobrzanski & Honysz, 2011; Tatli & Ayas, 2012). A virtual laboratory can be summarized as a series of computer programs that can be used to visualize microscopic and macroscopic phenomena in a certain scale so that learners can observe the salt hydrolysis phenomena on the material clearly and easily.

2.2 *Hypertext Markup Language version 5 (HTML5)*

Hypertext Markup Language Version (HTML) is the most common language used in web technology today. Microsoft and Google are using HTML on websites (Yibin, 2006). The latest version of HTML is HTML5, and this will become the new standard of design applications, though not all browsers should use it.

HTML5 is a programming language that structures the contents of *The World Wide Web*, and is a major technology on the internet (Zamroni et al., 2013). HTML5 will be the trend of the future for internet technologies because it is so enriched with features that it will surely be seen as standard web-based information media development.

2.3 *Hybrid learning*

Hybrid learning is learning that integrates innovation and technological advancement through online learning systems with the interaction and participation of traditional learning (Thorne, 2003). Hendrayati and Pamungkas (2007) state that the program hybrids produced today are the incorporation of one or more of the following dimensions: (1) Learning Face-to-Face (in-person learning) is used for learning activities in the classroom, in the laboratory, or for mentoring. (2) Synchronous Virtual Collaboration is a teaching format that is collaborative, involving interactions between educators and learners delivered at the same time. (3) Asynchronous Virtual Collaboration is a teaching format that is collaborative, involving interactions between educators and learners delivered at different times. (4) Self-Paced Asynchronous is a model of independent learning where people learn in their own time. This research uses a learning system that combines the dimensions of learning face-to-face with self-paced asynchronous learning.

The stages of hybrid learning, as shown by Lalima and Dangwal (2017), include: (1) Face-to-face teaching; (2) Student interaction with the course; (3) Peer group interaction; (4) Group discussion and exchange of ideas; (5) Accessing e-library; (6) Virtual classrooms; (7) Online assessment; (8) e-tuitions; (9) Accessing and maintaining tasks; (10) Webinars (application of hybrid learning); (11) Viewing expert lectures on YouTube; (12) Online learning through videos and audios; (13) Virtual laboratories.

2.4 *Independent learners*

Independent studying, according to the explanation of Weinstein et al. (2011), is the ability of learners to control their cognitive processes through planning, setting goals, and monitoring and evaluating their understanding of the subject matter. This is consistent with the explanation of Schunk (2012), that independent learning involves the potential for learners to possess self-control, self-observation and self-evaluation, so as to create individuals who understand their capabilities. White and Harbaugh (2010) also explain that independent learning is a form of consciousness and is the ability of learners to receive information, combine information, and be able to link information together.

Studies that have been done by Bernacki et al. (2011) found that applying a technology-based learning atmosphere can train a learner's ability to regulate their own learning. The application of a computer-based learning log is closely linked with the increase of independent learning. This is also expressed by Winters et al. (2008), who found that, through computer-based learning, learners are given the opportunity to organize, plan, and control their learning activities effectively with a high level of flexibility. This is supported by Greene and Azevedo (2009), who stated that independent learning in the monitoring aspects can be trained through the use of technology-based learning. Based on the above explanation, it can be concluded that independent learning is an attitude that leads to the activity and initiative of learners, enabling them to search for information to study, analyze and evaluate without being dependent on others. They are able to take overall responsibility in the learning process, mainly according to the competence and knowledge they possess in chemical materials salt hydrolysis. Active learners can be helped by the use of technology-based learning as a medium of learning. The aspects of independent learning used in this study are aspects that are dependent on others: responsibility, initiative, discipline, and confidence.

3 RESEARCH METHOD

This research was a mixed method research including both qualitative and quantitative research with embedded design (Creswell, 2012). The purpose of embedded design was to collect the quantitative and qualitative data simultaneously and sequentially. The reason for collecting these two types of data was to supply and support the primary data. The supporting data could be either quantitative or qualitative (Creswell, 2012). The qualitative data was obtained from observations and the quantitative data was collected from the questionnaire on independent learning. The questionnaire on independent learning used in this study was adapted from Hidayati and Listyani (2010), whose outline is shown in Table 1.

This research was conducted in the SMA Negeri 4 Yogyakarta, Indonesia. The population of this research were students in the science group in Year XI of SMA Negeri 4 Yogyakarta during the academic year 2016/2017. The samples were students from class XI-Sci-4 as the control group and class XI-Sci-5 as the experimental group, chosen randomly. Learning in both the control and experimental groups was carried out on the same topic: laboratory works and evaluations. Learning in the control group was face-to-face using the Direct Instruction (DI) method, where the delivery of materials was assisted by PowerPoint media and through laboratory work. While the learning in the experimental group was the same as that in the control group, the delivery system used was the hybrid learning method, in which face-to-face learning using Direct Instruction (DI) was combined with e-learning in a website-based learning system assisted by HTML5-based ViCH-Lab (Virtual Chemistry Laboratory) media.

Table 1. Content outline of questionnaire on independent learning.

No	Aspect	Number of statements
1	Confidence	4
2	Initiative	5
3	Motivation	4
4	Responsibility	5
Total		18

Table 2. Research design.

Class	Before treatment	Treatment of- 1	2	3	4	After treatment
Control	O11	P11	P12	P13	P14	O12
Experiment	O21	P21	P22	P23	P24	O22

where
O11: Independence of control class learning before learning process
O12: Independence of control class learning after learning process
O21: Independence of experimental class learning before learning process
O22: Independence of experimental class learning after learning process
P1i: Independent learning by using the face-to-face learning method, using Direct Instruction (DI), PowerPoint media, and laboratory work
P2i: Independent learning by using the hybrid learning method, which is the combination of face-to-face learning with Direct Instruction (DI) and website-based learning using ViCH-Lab media.

Independent learning was measured using a questionnaire with Likert 1–5 ratings and an observation sheet.

The measurement of independent learning using the questionnaire was carried out at both the beginning and the end of the learning process in order to collect quantitative data. The observations on the independent learning of the students were completed during each face-to-face learning activity by using the observation sheet to collect the qualitative data. The design of the data collection is presented in Table 2.

The data taken from each group before and after treatment, in both the control and experimental groups, was analyzed using normalized gain to measure the improvement of the students' independent learning. The normality test of the gain was undertaken by using the following equation (Hake, 1998).

$$g = \frac{S_f - S_i}{Sm - S_i}$$

where
g = gain
Sf = post-test score
Si = pre-test score
Sm = maximum score

The difference in the improvement of the students' independent learning between the control group and the experimental group was analyzed using an independent sample t-test with the requirement of data normally distributed and homogeneous. The statistical test was performed by using the SPSS V24.0 computer program. The hypotheses were as follows:

H_o: There is no significant difference in the improvement in independent learning between the students from the control group and those from the experimental group.
H_a: There is a significant difference in the improvement in independent learning between the students from the control group and those from the experimental group.

The improvement in independent learning during the learning process from 4 times face-to-face teaching method was collected by using an observation sheet, and the data was then analyzed by Least Significance Difference (LSD) in order to determine whether the improvement in independent learning in each session of regular face-to-face learning was significant or not.

4 RESULTS AND DISCUSSION

ViCH-Lab media, based on HTML5 media integrated in hybrid learning, included: (1) Competence; (2) Materials; (3) Laboratory work; and (4) Evaluation. The learning materials presented in the learning media were on the topic of hydrolysis for a chemistry lesson in the 2nd semester of Year XI. The ViCH-Lab interface can be seen in Figure 1.

In this research, HTML5-based ViCH-Lab media was used as a chemistry learning resource, which was used in chemistry hybrid learning. The purpose of the implementation of hybrid learning was to get a better learning model by combining the face-to-face learning model and the online learning model. The hybrid learning in this research was packed in a LMS (Learning Management System). Online learning was done outside the classroom by providing online materials that could be accessed through LMS, while face-to-face learning could be used as a question and answer process by teachers and students for certain topics

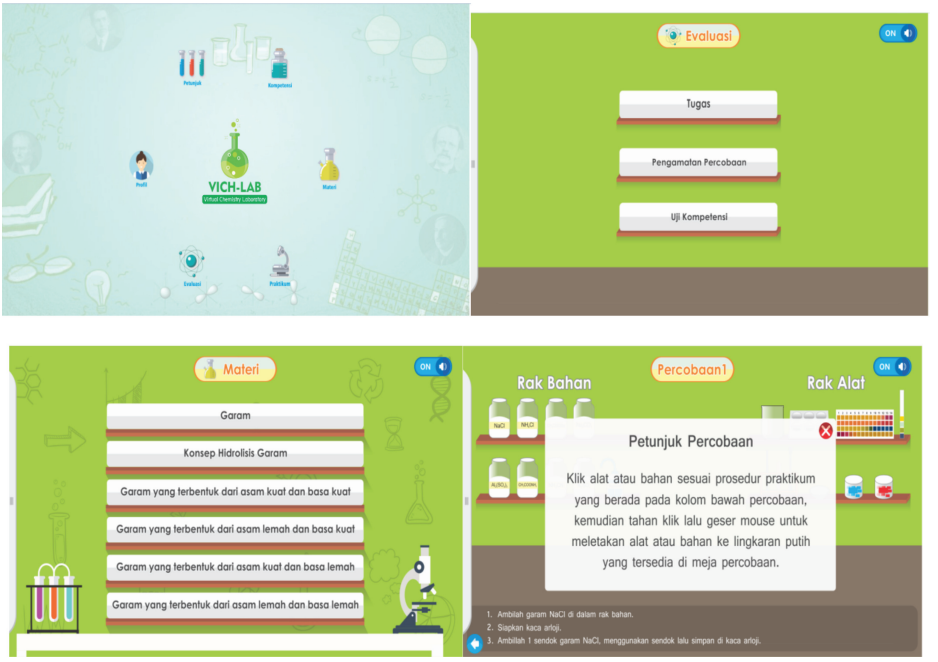

Figure 1. Interface of HTML5-based ViCH-Lab media on hydrolysis.

that were not clearly understood during the online learning. One kind of LMS that was used in this study was Moodle. The advantages of LMS in hybrid learning were the convenience for students in accessing online learning and the support for students when conducting the online model of hybrid learning. The learning processes were carried out in five sets of regular two hour face-to-face learning sessions in the control group, and its equivalent for the hybrid learning model in the experimental group.

Improvements in independent learning were noted from the data collected by the questionnaire at the beginning and at the end of the learning process. The improvement was expressed by the score of normalized gain. The analysis was conducted with an SPSS V24.0 program at 95% of confidence level. The average gain in independent learning in both classes can be seen in Table 3.

From Table 3 it can be seen that the average gain in the experimental group was higher than that in the control group. Therefore, it can be concluded that the improvement in independent learning of the students in the experimental group was better than that of those in the control group. The improvement in independent learning from time to time during the learning process was also observed during learning activities. The results of the observation can be seen in Table 4.

Table 4 shows that there was an increase in independent learning for every aspect measured in both the control and the experimental groups. The data analysis to determine the significance of improvement diversity through the observation result in every meetings for controled and experimented group using LSD test, while the independent sample t-test was done to study the significance of difference in the gain score in independent learning in the control group and the experimental groups. The LSD test and independent sample t-test were done with data that was normally distributed and homogenous. Normality test results can be seen in Table 5.

Table 3. Data of students' independent learning.

No	Group	Number of students	Score average		Gain average	Gain category
			Before learning	After learning		
1	Control	34	67.353	74.118	0.299	Low
2	Experiment	34	68.301	79.477	0.515	Medium

Table 4. The result of independent learning observation.

No	Aspect	Control				Experiment			
		I	II	III	IV	I	II	III	IV
1	Confidence	230	238	252	259	232	245	266	275
2	Initiative	333	348	363	375	342	373	386	398
3	Motivation	228	240	240	245	229	239	257	280
4	Responsibility	246	248	253	257	248	257	263	278

Table 5. Normality test results.

Variable	Group	Kolmogorov-Smirnov		
		Statistic	df	Sig.
Learning independence	Control	0.104	34	0.200
	Experiment	0.110	34	0.200

Table 6. Test results of independent samples t-test.

		t	df	Sig. (2-tailed)	Mean difference	95% Confidence interval of the difference	
						Lower	Upper
Independent learning	Equal variances assumed	5.651	66	0.000	0.224	0.357	0.453
	Equal variances not assumed	5.651	63.301	0.000	0.224	0.145	0.304

Table 7. Test results of LSD (Least Significance Difference).

	(I) Session	(J) Session	Mean difference (I – J)	Std. error	Sig.
Control	1	2	–4.056	2.418	0.103
	2	3	–3.944	2.418	0.113
	3	4	–2.963	2.418	0.229
Experiment	1	2	–6.963	2.873	0.021
	2	3	–6.426	2.873	0.032
	3	4	–6.611	2.873	0.028

The gain data for the control and the experimental groups were normally distributed; hence a t-test can be done to the gain data in the control and the experimental groups. The results of the t-test for both groups can be seen in Table 6.

The analysis shows that $t_{(66)} = 5.651$, and Sig. p was $0.000 < 0.05$, therefore H_0 is rejected. This result suggested that there was a significant difference in the increase in independent learning between the students in the control class and those in the experimental class. The significant differences in increasing independence can also be seen from the results of the LSD test, taken from the observations made during the learning activities. The LSD test results can be seen in Table 7.

Based on the results of the LSD analysis of the observation of independent learning in the control class, the probability (Sig.) for sessions 1–2, 2–3, and 3–4 are 0.103, 0.113, and 0.229, respectively. The result of the probability (Sig.) > 0.05, hence H_0 is accepted, which means that there is no increase in independent learning during sessions 1–2, 2–3, and 3–4. Meanwhile, the probability (Sig.) results of the LSD test of the observation of independent learning in the experimental class for sessions 1–2, 2–3, and 3–4 respectively are 0.021, 0.032, and 0.028. The probability result (Sig.) < 0.05, therefore H_0 is rejected, which means there is an increase in the students' independent learning during sessions 1–2, 2–3, and 3–4.

Based on the analysis, it can be concluded that ViCH-Lab media based on HTML5, when integrated in hybrid learning, affected the independent learning on the topic of salt hydrolysis of the students who were in Year XI during the 2nd semester. In line with the findings of this research, Bernacki et al. (2011) stated that a technology-based learning atmosphere led to learners being well trained in the ability to manage their own learning. The application of computer-based learning, which is closely related to the improvement in the students' independence, was also expressed by Winters et al. (2008), who reported that through computer-based learning, students were given the opportunity to organize, to plan and to control their learning activities effectively with high levels of flexibility. This was supported by Greene and Azevedo (2009), who stated that monitoring aspects in independent learning can be trained through technology-based learning. Tatli and Ayas (2012) stated that a virtual laboratory was able to make learning more meaningful through virtual experience, thereby enhancing

the understanding of concepts, principles, and processes. Through a virtual laboratory, students had the opportunity to repeat the experiments in order to understand the topic independently. Tuysuz (2010) also reported that virtual laboratory applications brought positive effects on the attitudes and achievements of students when compared to traditional teaching methods. The positive effects of a virtual laboratory are: (1) the existence of new learning materials in the digital format of ViCH-Lab media, therefore students feel more excited and interested in attending the learning process; (2) the students' learning becomes fun and relaxing through animation or simulation and they find it easier to understand the concept of learning. The media would be helpful and enable students to decrease the difficulties found due to the monotone modes of learning, which were reading or listening to the explanation of teachers; (3) it lengthened learning duration by being able to utilize cyberspace technology at any time; and (4) through ViCH-Lab, students were expected to be independent learners. In addition, HTML5 can be used individually and provides students with more opportunities to be independent learners outside of the classroom.

5 CONCLUSION AND RECOMMENDATIONS

The HTML5 based ViCH-Lab media that was integrated in the hybrid learning process has been successfully applied in chemistry lessons on the topic of salt hydrolysis in the science class of Year XI at the SMA Negeri 4 Yogyakarta during the academic year 2016/2017. There was a significant difference in the improvement in independent learning in the students from the experimental class, who learned the topic of salt hydrolysis in chemistry lessons through the learning model of hybrid learning, which is a combination of regularly scheduled face-to-face sessions and teacher supervised online practices through ViCH-Lab online, and those in the control group, who only learned the topic through regularly scheduled face-to-face sessions without the online components.

The best practices of the hybrid learning model, which can improve students' performance, would be an interesting investigation for future researches in other topics of chemistry.

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