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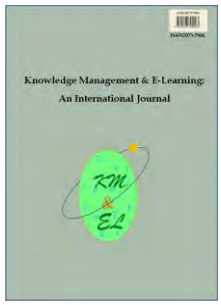

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Students' activities in, perceptions of and expectations for e-learning: A case in Indonesia

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Abstract: In this study, 52 students in Padang, West Sumatra, Indonesia used an e-learning system to study a chemistry topic. Students' e-learning activities were recorded, and their perceptions and expectations regarding e-learning were determined via an open-ended questionnaire after the study. There were more students who perceived e-learning as a difficult system to use than those who found it suitable. Most students did only few quizzes and spent less time on e-learning materials. Low activity in e-learning was related to conventional classroom instruction that had been accustomed practice and to the difficulty of reading materials on the screen. This study found students' expectations for e-learning in terms of design, content, and learning atmosphere. First, it is important to design a readable website by choosing the best line length, line height, font style, font size, and font-background color combination. Next, the provision of instructional videos and pictures, comprehensive resources and worked-out examples would develop students' self-confidence to learn through e-learning. Lastly, social features namely synchronous discussion forum and display of online users were noted to sustain students' interest in e-learning.

Keywords: e-Learning; Design; e-Learning content; e-Learning atmosphere; Learning activities; Perception; Expectation; Indonesia

Biographical notes: Guspatni is a lecturer in the Department of Chemistry, Universitas Negeri Padang, West Sumatra, Indonesia. She received her Master's degree in Technology and Learning from University of Nebraska-Lincoln, USA. Her research interests include technology-enhanced learning, multiple representations in chemistry learning, and memory and cognition.

1. Introduction

Covering all prescribed content is a teaching challenge. Conflicting academic activities, time constraints, limited classroom access, and unexpected interruptions for national and institutional activities are some common problems found in Indonesian university settings. Lecturers cram much content into few full days or assign students to read materials and do assignments with little opportunity to provide them feedback regarding their learning. For instance, general chemistry consists of eight broad topics and is taught in 16 x150 minutes in the semester. Due to situational problems, lecturers skip some materials to finish topics which are considered more difficult and then expect students to study the materials independently. On the other hand, students are accustomed to direct supervision and control from lecturers during study. Students cannot comprehend the concept if

lecturers do not give direct teaching and assignment. Unfortunately, these problems cause students to neither learn the lesson nor get any feedback for self-assessment.

In an attempt to address these issues, e-learning was introduced to general chemistry course in an undergraduate chemistry class. e-Learning was delivered through a website that contained learning materials, quizzes and their corresponding feedbacks, and links to important references and videos accessible at all time in the semester. Feedback has a very big influence in learning (Hattie & Timperly, 2007) but it gives challenges for teacher to provide it (Ramani & Krackov, 2012). In this study, feedback was incorporated in the website and was given after students submitted the quizzes. Each quiz was followed by an effective, automatic and immediate feedback for it engaged students to correct their mistakes (Thurlings, Vermeulen, Bastiaens, & Stijnen, 2013). Software-programmed feedback gives such a great value for both students and teachers because it is clear, easy to read, easy to understand, quick and consistent, and it can reduce teachers' workload (Debuse, Lawley, & Shibl, 2008; Denton, Madden, Roberts, & Rowe, 2008).

The use of e-learning enhances chemistry teaching and increases students' interest to learn chemistry (Awad, 2014). e-Learning that consists of video tutorials, problem tutorials, homework activities, and web-based teaching learning is a flexible tool to improve students' mastery of chemistry problem solving and has a significant positive impact on students' performance (Dori, Barak, & Adir, 2003; Eichler & Peeples, 2013; He, Swenson, & Lents, 2012; O'Sullivan & Hargaden, 2014). This pilot study was carried out to introduce e-learning to chemistry instruction in Padang, West Sumatra, Indonesia and then examine students' activities, perceptions, and expectations in studying chemistry topic through e-learning. Time spent on learning material pages and number of quizzes completed were recorded to obtain general description of students' activities in e-learning. What give value to this study are the setting and the context of the study that add a new dimension to the existing literature.

2. Conceptual framework

e-Learning is defined as technology-based especially Internet-enabled learning (Gunasekaran, McNeil, & Shaul, 2002), be it web-based, web-distributed or web-capable learning (Nichols, 2003). e-Learning is not only for distance learning but also for complementary of face-to-face instruction (Anand, Saxena, & Saxena, 2012). It can be done either synchronously or asynchronously (Nichols, 2003; Welsh, Wanberg, Brown, & Simmering, 2003). [Synchronous e-learning requires learners to be online at the same time during instruction; Asynchronous e-learning usually allows students freedom of choosing when to engage the content.]

The benefits offered by e-learning have led to widespread adoption by educational institutions, business and governmental agencies around the world. In the US, the growth of e-learning in colleges and universities has resulted in greater access and scheduling flexibility (Bell & Federman, 2013). In rural areas, e-learning develops social and mental ability and fills the gap between educated developed cities and rural undeveloped areas (Anand et al., 2012). Other benefits of e-learning include cost effectiveness, lifelong learning, global customers, just in-time access to knowledge, personalization and diversity, collaboration and interactivity, working-learning lines blur, tracking improvement, and information overload lessening (Agariya & Singh, 2012; Gunasekaran et al., 2002; Waight, Willging, & Wentling, 2002; Welsh et al., 2003).

Students who find the system easy to use and useful for their course work have a positive attitude towards e-learning (Adewole-Odeshi, 2014). Learners' attitude and satisfaction are affected by computer anxiety, instructor attitude towards e-learning, e-learning course flexibility, e-learning course quality, and diversity in assessments (Bertea, 2009; Sun, Tsai, Finger, Chen, & Yeh, 2008). Yet, other study by Keller and Cernerud (2002) revealed that the implementing strategy is more significant in influencing students' attitude towards e-learning than students' background (previous knowledge of computers, attitude towards new technologies, gender, age, and learning style). Students discover that e-learning appears to be at least as effective as traditional instructor-led methods such as lectures (Ruiz, Mintzer, & Leipzig, 2006). The likelihood that a student will continue to use e-learning is predicted by student's self-efficacy and motivation (Liaw & Huang, 2011).

For an effective use, e-learning should be underpinned on explicit theories, principles and pedagogies (Nichols, 2003). Abrami, Bernard, Bures, Borokhovski, and Tamim (2011) summarized four learning principles that must be met for the usefulness of e-learning including self-regulation theories, multimedia learning principles, motivational design principles, and collaborative and cooperative learning principles. In regard to this, several e-learning platforms participate to provide the best e-learning system. With these platforms, e-learning can be designed so that it does not only provide cognitive content, but also provides features to meet motivational, social, and multimedia learning principles. The most extensively used e-learning tools are Moodle, Sloodle, LectureShare, BlackBoard, Blogs, Wikis, Emails, Messenger, and e-learning 2.0 (Kumbhar, 2009). Instructors may choose any platform that best suits the goal of learning. In fact, it is not the platform or the tool but the way it is used, managed, and aided to achieve learning goal that will serve the most important factor in e-learning (Keller & Cernerud, 2002; Nichols, 2003).

In this study researcher used LiveCode to design e-learning website. LiveCode is a programming language created by Runtime Revolution Ltd. from Edinburgh, Scotland, United Kingdom. LiveCode uses a high level, english-like programming language that is dynamically typed. The language contains advanced features including associative arrays, regular expressions, support for a variety of SQL databases, and TCP/IP libraries (https://en.wikipedia.org/wiki/LiveCode). Using these features, pages for learning material, quiz, and discussion were made. For research data, e-learning accesses which included learning material pages visited and the access time (determined from GuidePage record) and number of quizzes done (determined from makeTest and checkTest records) were recorded. Access duration on learning material page was considered as the time that students spent to read learning material, thus it was regarded as learning activity. In addition, activity in quiz was also considered as learning activity, for the quizzes were aimed to guide students learn the material. Therefore, this study addressed the following research questions:

- To what extent do students read learning material in e-learning?
- Can students complete all the quizzes in e-learning?
- What are students' perceptions and expectations in studying chemistry through e-learning?

3. Methodology

3.1. Context and setting

Participants of the study were students who took general chemistry course in the Department of Chemistry, Universitas Negeri Padang, Padang, West Sumatra, Indonesia. 56 students were registered in the course, but four of them never logged on to e-learning website changing the total number of research participants to 52 students. Students were asked but not forced to take e-learning course. Students who did not want to take e-learning could attend other regular class without restriction on the grade.

Padang, a city where the study was carried out, is the capital city of West Sumatra province, Indonesia. Padang has a width of about 695 km^2 and a population of around one million people, and it has become the center of education in the province (https://en.wikipedia.org/wiki/Padang). According to SPEEDTEST (www.speedtest.net), the average Internet connections in Padang were 2 Mbps and 0.5 Mbps for download and upload speeds respectively. The speeds were quite slow, but users could get faster Internet connection by choosing better Internet plans. In this study, students could access the Internet freely through LAN or Wi-Fi at the university. In addition, they could pay rent access at an Internet Café or purchase an Internet package sold by cellular companies. Thus, students were given cash to acquire adequate Internet access off campus.

Participating students were provided an e-learning experience in nuclear chemistry, a general chemistry course topic. e-Learning was delivered through a website containing learning materials, quizzes, and links to important references and videos. The materials were suited to those stated in the curriculum. In addition, links to important references were provided on the pages. The quizzes were in multiple-choice, matching, order sequencing, essay, and short answer formats. Students needed to choose, match, order or fill in the right answer to the questions. Students would get immediate feedback for the quizzes submitted. When it was wrong, students could redo the same quiz which displayed either the same or similar question. The website was adopted from one created by Brooks et al. (2007) from University of Nebraska Lincoln, Nebraska, USA.

3.2. Design of e-learning website

Chen, Lee, and Chen (2005) found that information overload, disorientation, and adaptive mechanism deficiencies in web-based learning place a large burden on learners. Therefore, in current e-learning website, different concepts or materials were grouped into subcategories developed as separate pages. e-Learning website consisted of 47 learning material pages. Each page was connected to other pages using previous and next button navigations. When needed, extra information about a specific concept was accessible through "blue linked-words or phrases" in the text. Learning materials on each page were mostly displayed in a text form. On average, there were about 94 words (excluding number, exponential, table, and chemical equation) on each page. Moreover, there were diagrams, pictures and tables on certain pages to explain the concepts. To assess students' understanding, 55 quizzes were offered on almost all of the pages. Access to the quiz was through green rectangle button on the page. After a student submitted an answer, immediate feedback was provided. In addition to learning material pages, e-learning website also consisted of one main menu page, one discussion page, and one list of topics page. After students logged on to the course, they would be directed to main menu page where the links to discussion page and list of topics page were provided. On list of topics page, students could choose any topic and go to its

corresponding learning material page. On learning material page were links to main menu page and list of topics page.

The appearance of e-learning website was made simple. It was 800px in width and center floated. The main text area, the section where learning material was put, was designed with light gray background-color, black colored-text, justified text aligned, 22px line height, Verdana and sans-serif font family, and 12pt font size. The line length of the text was at utmost 120 characters (with spaces). The appearance of e-learning website is shown in Fig. 1.

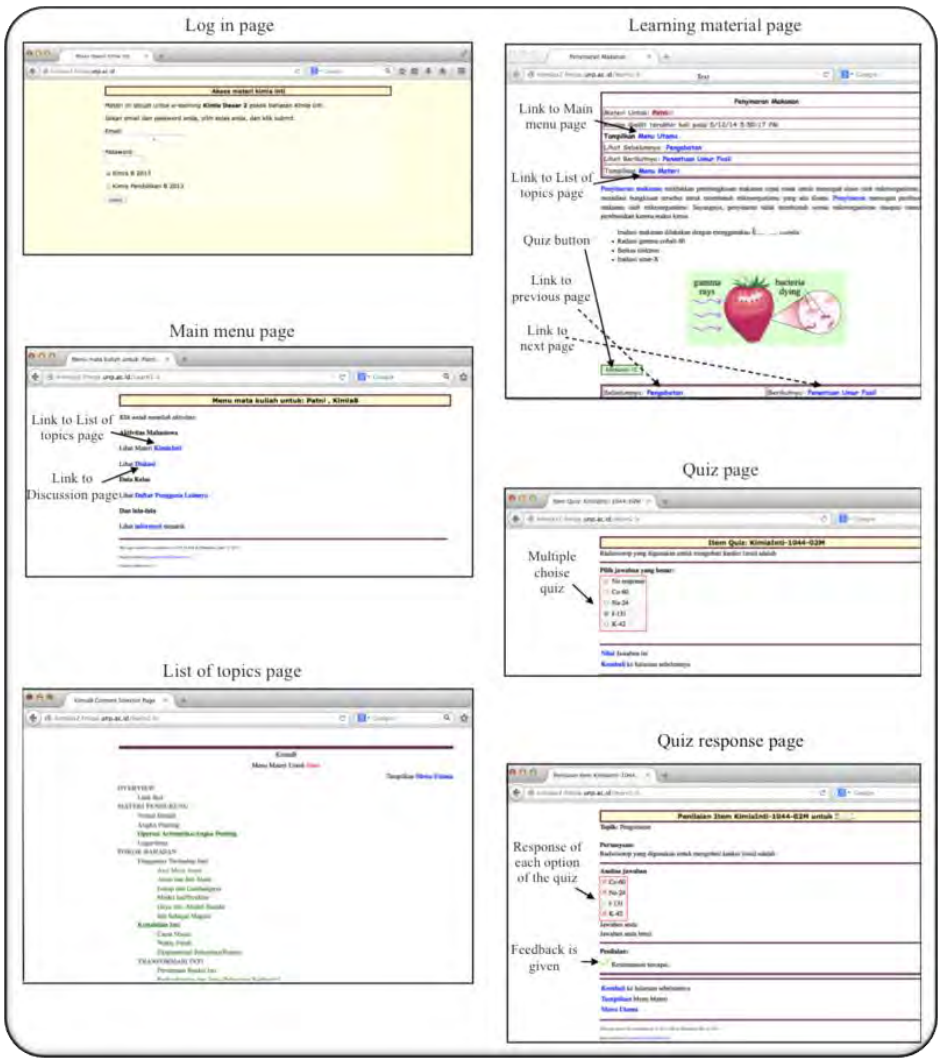

Fig. 1. The appearance of e-learning website

3.3. Instruments

Instruments of this study were e-learning record and open-ended questionnaire. Each student used an id to log on to e-learning website. Consequently, each student developed

personal record of any activity made in the website. The recorded activities were pages visited, access duration on each page, the number of quizzes completed, and the number of attempts on each quiz (see Fig. 2). Access durations on learning material pages (determined from GuidePage record) and number of quizzes completed (determined from makeTest and checkTest records) were then analyzed. The result provided a generalization of students' activities in e-learning.

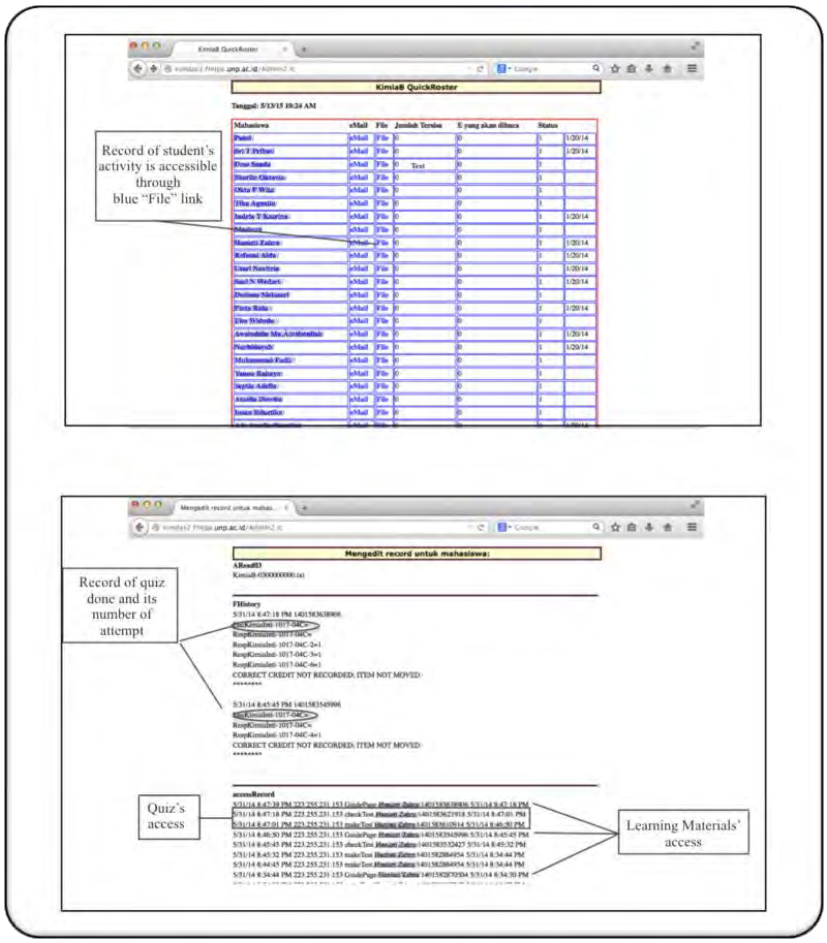

Fig. 2. Recorded data of students participating in e-learning

In the open-ended questionnaire, students were asked to write comments about their experience in e-learning. The questionnaire consisted of two main items: (1) the implementation of e-learning, and 2) the appearance and content of e-learning website. To get genuine responses, students were clearly informed that their answers would not affect their grades neither affected their personal and institutional profiles. For those reasons, questionnaires were returned anonymously by students. In addition, three demographic data of participating students were included in the questionnaire. They were (1) the frequency of Internet access, (2) tool mostly used to access e-learning, and (3) places to access e-learning. Students were asked to choose one of 5 options on how often they used Internet either for browsing, emailing, or social media activities (1 for never, 2 for rare, 3 for moderate, 4 for often, and 5 for very often). Places to access e-learning

might include Wi-Fi coverage area on campus, ICT laboratories, home, and Internet Cafés. Tools to access e-learning at home might include computer, laptop, tablet, and mobile phone. Students were asked to rank order the places and tools they mostly used for e-learning access.

4. Result

4.1. Demographic data of participating students

In general, participating students were accustomed to Internet. Most of students accessed e-learning from house with laptop as the mostly used tool to access e-learning. Demographic data of participating students is presented in Table 1.

Table 1
Demographic data of participating students

	%
Frequency of Internet access	
Very often	16
Often	56
Moderate	22
Rare	6
Never	0
Place to access e-learning	
House	42
Internet café	28
Wi-Fi	22
Computer Lab	4
Tool mostly used to access e-learning at home	
Laptop	88
Desktop computer	4
Tablet	2
Hand phone	2
None	4

4.2. Questionnaire data

Open-ended questionnaire consisted of two items, but some students left one item in the questionnaire blank. Students' answers were quite varied. 29 students did not give

comment on e-learning implementation. 11 students stated that e-learning was not suitable for their learning as described by comments below:

- "e-Learning was frustrating. We did not have fast Internet connection to access it both at the university and at home. We could not always get online."
- "e-Learning could not effectively guide students to learn. We did not have direct communication with lecturer to ask questions. We followed e-learning at the end of the schedule just to do the quiz."
- "e-Learning was difficult and tiring because we should look at the screen to read material."

Nine students indicated that they liked e-learning as implied by comments below:

- "e-Learning system eased students to learn at anytime from anywhere we like."
- "e-Learning eased students to access learning material and to hand in assignment. It was practical because we could directly find further information and concepts that we did not understand online."

Three students stated both the benefits and the drawbacks of e-learning as described by comments below:

- "I liked e-learning system. As new to this, however, I did not understand how to learn through this system, and I could not manage time to learn."
- "e-Learning asked students to manage time and be more curious. But it decreased the communication between lecturer and students."

Students had diverse comments on the content and appearance of e-learning website. Few students thought that e-learning website was organized and perfect as it was. Other students commented and gave suggestions to modify the content and appearance of e-learning website. 25 students commented on the importance of interaction among students and between students and lecturer in e-learning. They suggested providing a scheduled and directed discussion forum for a synchronous communication. They also suggested displaying users who were online so that they could feel togetherness in e-learning. 25 students suggested to make e-learning website more attractive designed with eye-friendly colorful background and completed with more instructional pictures and videos. 13 students wished to get more resources and worked-out examples to help them understand the concepts. 5 students asked for more easy-navigated website where all of the navigations and their corresponding pages were displayed interchangeably in a single page. 3 students realized that the font style, font size and line height of the text were tiring and difficult to read. 3 students commented that they did not like immediate feedback giving correct response if the next quiz displayed exactly the same question.

4.3. Website record

Each student had personal record page of his or her online activities in the study. Their records were moved from record pages to excel sheets for descriptive analysis with Real Statistics, a data analysis tool. Students' activities in e-learning were not normally distributed (see Table 2). 4 out of 6 categories of the data had outliers that came from the first and second highest scores in the distribution. Analysis revealed that students' activities in e-learning skewed to the right indicating many records fell below the mean. The ratios of the number of students whose activities below the mean to the number of

students whose activities above the mean are 33 to 19 in the category of time to access e-learning, 27 to 24 in the category of time to access learning material pages, 35 to 17 in the category of number of quizzes completed, and 28 to18 in the category of number of attempts for each quiz (3 students had score equalled to mean). On average, students spent 206.89 minutes in e-learning. This time was less than it would be in normal classroom instruction (300 minutes). The average time that students spent to access learning material pages was 57.20 minutes. In this study, access on learning material page was considered as reading activity. On average each student spent 0.82 minutes on each learning material page. It implies that on average student needed 0.82 minutes to read 94 words, or on average student could read 115 words in a minute. If time spent for reading diagrams and pictures is counted, the number of words read per minute will be fewer.

Table 2
Analysis on students' activities in e-learning

	Total time in e-learning (min)	Time spent on learning material pages (min)	Time spent per learning material page per student (min)	Time spent on quiz (min)	Percentage of quiz done	Attempts per quiz
Descriptive statistic						
Mean	206.89	57.20	0.82	122.79	33.43	2.36
Standard Error	24.72	5.79	0.10	19.09	3.79	0.08
Median	164.03	56.51	0.56	76.85	25.45	2.18
Standard Deviation	178.27	41.74	0.74	137.66	27.31	0.58
Skewness	1.55	0.72	2.57	2.36	1.18	0.47
Shapiro-Wilk Test						
W	0.85	0.94	0.71	0.72	0.86	0.94
p-value	9.72E-06	1.51E-02	8.62E-09	1.37E-08	2.35E-05	1.25E-02
alpha	0.05	0.05	0.05	0.05	0.05	0.05
normal	no	no	no	no	no	no
Outliers and Missing Data						
Number of outliers	2	1	2	2	0	0
Number of blank	0	0	0	0	0	3

The average time that students spent to do the quiz was 122.79 minutes. Three students never accessed nor did the quiz. In contrast, two students did all of the quizzes in the website. On average, students completed 33.43% of the quizzes. The average number of attempts per quiz was 2.36 times. Two third of the total number of students attempted the quiz less than the mean attempt. But on average, none of the students could do the quiz in a single attempt. There were 10 quizzes that required chemistry and mathematics

understanding. Only 25 out of 52 students attempted those quizzes. The average number of those quizzes completed by students was 5.80 and the average number of attempts for each quiz was 2.1.

The remaining 26.90 minutes in e-learning access were used to navigate the website. They included navigation on main menu page, list of topics page, and discussion page. In addition to discussion page, students were informed that they could use email to ask questions to lecturer. But less than 5% of the total number of students used the email to inquire about concepts that they did not understand. After the schedule for the topic ended, none of the students ever revisited the website.

5. Discussion

5.1. Learning activity in e-learning

This study was carried out to introduce web-based chemistry instruction to undergraduate students in Padang, West Sumatra, Indonesia and then evaluate students' activities, perceptions, and expectations in their e-learning experience. Students in this study were frequent Internet users. Online activities such as browsing, emailing and social media activities were usual things for students. In contrast, students unfortunately put off visits to the e-learning website until the end of the scheduled time. In line with the finding of this study, other researchers (Deng & Tavares, 2015) found that learning engagement in e-learning with such formal context and display was limited. Students did not visit the website before the scheduled period or revisit it after the study. Their activities in current study were not normally distributed. All of the data revealed positively skewed distribution where many students had low participation in e-learning be it in time spent in e-learning, in time spent to read learning material, or in number of quizzes completed. The number of attempts on a quiz had a positive skewness where many data laid below the mean. Nevertheless, data also suggested that students could not answer the quiz in a single attempt.

In the questionnaire, students acknowledged that in e-learning they liked doing graded quizzes better than reading and learning the materials. Students did admit that grade for the course – the reward - was the main reason they did the quizzes and took part in e-learning (Groves & O'Donoghue, 2009). Without a grade, students might not enroll in e-learning. Furthermore, although grading on the quizzes was said to be the main reason they followed e-learning, students were unable to complete all of the quizzes. On average students did a third of the total quizzes. Less than half of the total number of students did quizzes that required chemistry and mathematics understanding. As opposed to Butchart et al. (2009), students did not develop critical thinking in e-learning. Students argued that the quizzes were not allied to the text provided in the web when in fact the quizzes were actually inferred from the materials. Students may not be able to comprehend the materials and develop further understanding. Else they did not open and read additional materials accessible on the blue linked- words or phrases on the pages. Apparently, students needed clear instruction and comprehensive materials. They also wished for more examples of concepts as well as problem tutorials, especially of problems that required calculation (O'Sullivan & Hargaden, 2014). Students were used to teacher-centered instruction and they were unconfident of accomplishing learning without direct instruction from lecturer. Thus, in e-learning where communication with lecturer is limited, more worked-out examples and resources such as video tutorials and

problem tutorials (He et al, 2012; O'Sullivan & Hargaden, 2014) are very important to help students understand the lesson.

Almost all of the participating students had personal tool such as laptop, desktop computer, tablet or handphone to access e-learning. Along with cheap Internet package sold by cellular companies, students could obviously access the Internet frequently especially for fast and light-loaded sites such as Facebook, Messengers and other social medias. On the other hand, students unfortunately did not get into e-learning as much as they got into Facebook and other Internet activities. If compared to learning time in normal classroom instruction, students spent less time in e-learning. Students are accustomed to accessing "pleasurable" websites as opposed to serious, formal, high-loaded and demanding websites with expectations for learning. In line with other studies (Ebrahimi, Faghih, & Marandi, 2016; Zhang & Nunamaker, 2003), easy navigated and attractive website designed with eye-friendly colorful background, instructional pictures, animations and videos would have encouraged students to engage in e-learning.

In this study, students spent less than a minute to read an average of 94 words per learning material page. At utmost, students could read 115 words in a minute which is fewer than the average reading speed of Indonesian adults who never took speed reading training—175 to 300 words per minute (Soedarso, 2006). According to Kendeou and Broek (2007), reading deep and demanding literature such as science text is time consuming, especially if it is read by reader who has erroneous and limited prior knowledge about the text. However, participants of this study were chemistry major students who had learned nuclear chemistry topic in their senior high school and thus had prior knowledge about it. Therefore, three possible explanations for students' slow reading in this study are: (a) students were slow readers, (b) students got difficulty to read on-screen text, and (c) students read the text and tried to understand it. Should the last explanation be true, students could have otherwise completed the quizzes in a single attempt.

Apparently, low activity in current e-learning was related to the convenience of reading on-screen text. The problem might relate to the font size, font style, line height, and line length of the text. In this study, the font style was Verdana- san-serif and the font color was black on light background - the most legible font style and color combination for the web (Erdogan, 2008). Still, there were few students who noted the difficulty of reading the text. Other possibilities might come from the small line height and the long line length of the text. The line height of the text was 22px which is less than 1.5 line spacing for Verdana with 12pt font size (CSS line-height Property, 2016). The line length of the text could contain at utmost 120 characters. This length is more than twice of the recommended length for an effective and high comprehension of on-screen text reading for both normal and fast speed readers (Dyson & Haselgrove, 2001).

5.2. Students perceptions of and expectations for e-learning

Many students perceived e-learning as a difficult system to implement. Low Internet connection, lack of communication and low self-assurance to comprehend learning materials were reported as students' challenges in this mode of learning. In fact, technological issues, academic confidence and communication are common issues of e-learning implementation found in both developed and developing countries (Andersson & Gronlund, 2009; Frehywot et al., 2013; Quimno, Imran, & Turner, 2013; Qureshi, Ilyas, Yasmin, & Whitty, 2012; Zoroja, Skok, & Bach, 2014). e-Learning website included pages containing texts, symbols, pictures, and videos for learning material. As compared

to informal sites usually visited by students, e-learning website was more heavy-loaded. e-Learning can be frustrating if it cannot simply be accessed by students. This is particularly true if e-learning is given to students who are either inexperienced or less experienced with e-learning. Stark, Lassiter, and Kuemper (2013) found that Internet access is the biggest predictor of performance in an online course for novices or lower-level students. Therefore, it is very important to provide a fast and stable Internet connection so that students do not get irritated and can study well in e-learning.

Besides getting comprehensive resources, students expected to have a synchronous discussion forum to interact and get the sense of social presence and collaboration (Abrami et al., 2011). In line with other findings (Deng & Tavares, 2015; Gilbert, Morton, & Rowley, 2007; Zhang & Nunamaker, 2003), less interaction could be the problem in current e-learning which had appeared to undermine students' satisfaction to follow it. In fact, to assist cognitive processing, social presence is strongly advisable in e-learning (Cavus, Uzunboylu, & Ibrahim, 2007; Gutierrez-Santiuste, Rodríguez-Sabiote, & Gallego-Arrufat, 2015). Similarly, Topchyan (2016) found that interactive response as one of social presence dimensions does relate to knowledge sharing in virtual and distance learning. As suggested by participating students, online users can be shown on the page so that students would not feel alone and know that they have friends to interact with during learning. Instructor needs to direct and control the interaction during learning. Being a key to the success of e-learning initiatives, the interactivity in e-learning can be increased through a mandatory participation during learning (Adiele & Nwanze, 2010).

Few students commented that they did not like immediate feedback giving correct answer. Because set to provide question randomly, one quiz button could present exactly the same question when attempted more than once. Students, especially those who only wanted to finish the quiz and get "completed" score, might note down the right answer and then continuously clicked the quiz button to get exactly the same question. In fact, on average students attempted a quiz more than once in this study. To deal with this issue, score and the number of attempts on each quiz should be shown on the page, so students would be more attentive to do the quiz.

5.3. e-Learning effectiveness

In this study, the effectiveness of e-learning was not quantitatively compared with that of conventional classroom instruction. The same evaluation was not given into the two modes of instruction. Yet, several comparisons were assumed. Firstly, in conventional classroom instruction, lecturers either gave assignments or quickly reviewed some materials in certain topics so that all of the topics stated in the syllabus could be taught to students. Fortunately, when e-learning was implemented, the scheduled time of the semester could be used for almost all of the topics. Secondly, feedback was not always given in conventional classroom instruction since lecturers could not return the graded assignment to students in time. On the other hand, e-learning appeared to be relatively effective in giving feedback. Quiz functioning as a formative assessment could provide responses to any answer given by students. When students did a quiz, they could see the correct and incorrect answers. Therefore, students could learn what was expected from the problem.

e-Learning did not meet all types of learner. Yet, it was found that e-learning brought several advantages especially for certain students. Firstly, e-learning eased students to learn and hand in assignments as they did not have to go to campus and meet the lecturer. Secondly, it directed students to find many resources from the Internet. e-Learning is an Internet-based learning mode. While accessing e-learning website,

students could access other sites in a browser to get guidance to learn the materials. Lastly, e-learning led students to be more curious in learning. Online resources would offer more information to students which then boosted students' curiosity in learning.

6. Conclusion

Students' activities in e-learning were low and not normally distributed. There were more students who spent less time in learning the materials and did few quizzes than those who had high records in the two activities. Graded quiz was considered as the main reason for students to take part in e-learning. However, students could not complete all of the quizzes and answer each of them in a single attempt. To fulfill curriculum demand, quizzes were designed so that they did not only ask students to memorize, but also required students to understand, apply and analyze chemistry concepts and principles to solve the problems. Therefore, it is very reasonable that students needed comprehensive resources to learn the materials. In current e-learning, more worked-out examples and supports should have been provided to help students understand the lesson.

Furthermore, students did not spend much time on a learning material page. Yet, their speed of reading was shown slower than that of the average Indonesian normal speed reader. Instead of trying to seriously read and understand the text, it is suggested that students were either slow readers or getting difficulty to read the text on the screen. Thus, practitioner should consider the convenience of reading the on-screen text by choosing the best combination of line length, line height, font style, font size, and font-background color of the text.

e-Learning could help lecturer to effectively use time to teach materials and give feedback on students' performance. e-Learning was useful for students because it eased students to learn, hand in assignments and get learning resources. However, introducing e-learning to students who are used to classroom and teacher-directed instruction needs very well preparation and implementation. They include (1) design of e-learning website, (2) content or material put in e-learning, and (3) learning atmosphere in e-learning. The last is related to social presence and collaboration in e-learning. This condition can be created by providing synchronous discussion forum and display of online users in the website.

7. Implication for practitioner and future research

University as learning facilitator needs to provide a fast and stable Internet (both Wi-Fi and LAN) connection on campus so that e-learning can be accessed by all of the students. When e-learning is being introduced, practitioners need to provide more resources and worked-out examples (especially the downloadable versions of materials) so that students can begin to learn independently. In addition, students expectations including e-learning website that has attractive and convenient look and e-learning website that provides social features are other important factors to consider when implementing e-learning.

This study was limited to one college where almost all of the students were Minangese (similar to Malay clan) and most of the students came from family with low to middle income. This study was also done in a place where Internet connection was neither very fast nor stable. Other study should be taken from institutions that have more diverse population of students and have stable and fast Internet connection. Moreover, e-

learning was implemented in nuclear chemistry topic. Additional research should include variety of topics and subjects.

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