2nd International Conference on Modern Research in
EDUCATION, TEACHING AND LEARNING

ICMETL
PARIS, FRANCE
20-22 NOVEMBER, 2020

Student's Perception Toward the Virtual Textile Chemistry Laboratory in Learning Making Cellulose Based Regenerative Textile Fiber

Winwin Wiana[1], Cucu Ruhidawati[1]

1. Fashion Education Study Program
Indonesia University of Education (UPI)
Dr. Setiabudhi Street No. 207 Bandung-Indonesia

ABSTRACT

The main problem often encountered by the students in learning textile chemistry in general is the difficulty of students in digesting and mastering the chemical process and the formation of fiber which is abstract and complicated, especially in the mechanism of regenerative fiber formation. This study aims to determine the students' responses and interest towards the use of a Virtual Textile Chemistry Laboratory model in learning making cellulose-based regenerative textile fiber. One effort that can be taken as a solution to these problems is the development of a virtual laboratory model. The virtual laboratory is rapidly developing its use in science learning, especially chemical materials, because it is proven to provide significant benefits to the learning process and outcomes. The limited laboratory facilities in learning Textile Chemistry, has encouraged the development of virtual laboratory applications and their use in learning Textile Chemistry on the topic of Making Cellulose-Based Regenerative Textile Fibers. The purpose of this study is to review students' perceptions of the use of the Virtual Textile Chemistry Laboratory (VTCL) application and describe and compare these perceptions with relevant previous research results. Perception aspects surveyed are innovation, motivation, effectiveness, and its benefits in increasing student understanding on the material presented. The results of data analysis showed that the highest percentage of positive perceptions was in the aspect of innovation (94%), followed by the motivational aspect (89%), the Easiness aspect (90%), and the Benefit aspect (87%). Based on the results of data analysis, it can be concluded that most of the students (90.75%) have a positive perception of the use of VTCL in learning making cellulose-based regenerative textile fibers in the Textile Chemistry course and there are small number of students (9.25%) have a negative perception.

Keywords: Virtual Textile Chemistry Laboratory, Cellulose-Based Regenerative Textile Fiber.

1. Introduction

The most common problem faced by students in studying chemical materials is because Chemistry has a high degree of difficulty in understanding due to the abstract and incremental characteristics of chemistry. Likewise with the study of Textile Chemistry, where in general students find it difficult to digest and master the chemical process and the process of forming fibers that are abstract and complicated, as Dwiningsih et al [3] said that Chemistry in Indonesia is still considered difficult to learn. One of the reasons is that chemistry material is largely abstract. Whereas Ayas & Demirbas [2] argue that Chemistry is perceived by students as a challenging subject, since it is difficult to construct the abstract concepts frequently encountered in the subject area.

These conditions need to be anticipated as quickly as possible with a variety of efforts, one of which is to develop a virtual laboratory media. Citing the opinion of Kumar et al [8] that The Virtual Learning Environment (VLE) offers an integrated learning environment. In this VLE, the students can access the course, take tests, interact with the lecturers and classmate visually by using internet. In the order of the learning process, Woodfield [16] "Virtual laboratories simulate a real laboratory environment and processes, and are defined as learning environments in which students convert their theoretical knowledge into practical knowledge by conducting experiments". Many research results show the ability of virtual laboratories in improving the quality of learning outcomes in various fields of study, especially in Chemistry. Virtual Laboratory considered has educational potential because it provides opportunities for 'learning while doing'. It also provide access to systems that are not accessible due to reasons such as security, cost and size. Users can also explore various scenarios, such as what if the input is changed, and observe the effect on the output (Lavanya Rajendran, Ramachandran Veilumuthu, Divya. J) [10]. In their study Gunawan et al. [5] have found that students who study with Virtual Laboratory have higher generic science skills than those who are studying conventionally. Learning with Virtual Laboratory improves the ability of logic inference and the ability to build physics concepts. Not only in the order of concepts, virtual laboratory also has a good effect on improving learning outcomes in the aspect of creativity, as revealed by Herga & Dinevski [7] state that "virtual laboratory open up a whole new world of creativity in learning". This is in line with the opinion of Oidov et al. (2012) [9] which states that the animation in the virtual laboratory can be used as an ideal demonstration tool to present an event. In accordance with the stages of virtual laboratory usage in the period of demonstrate, students can actively and creatively use the tool towards meaningful experimental results.

1.1 Virtual Textile Chemistry Laboratory

Virtual Textile Chemistry Laboratory which is developed as a logical manifestation of efforts in improving learning outcomes in Textile Chemistry, especially in the manufacturing of cellulose-based regenerative textile fibers, it is carefully designed in various aspects, namely: Easy navigation, Cognitive content, Integration media, Aesthetics, and the overall function. This stage is the stage of making a multimedia interactive learning design in the form of a virtual laboratory with reference to the results of the needs analysis from the previous analysis stage. Based on the analysis that has been developed, we get a concept of

"simple desktop". In this concept, virtual laboratory devices are designed with a simple, easy to use, and attractive appearance, one of them is by applying simple animations. With an overview of such concepts and to facilitate the process of developing a Virtual Textile Chemistry Laboratory media at the development stage, then at this design stage a user interface design is made as follows:

1.1.1 Users Interface Development

Several examples of the interface of multimedia learning that have been developed:

Figure 1. Virtual Textile Chemistry Laboratory Home

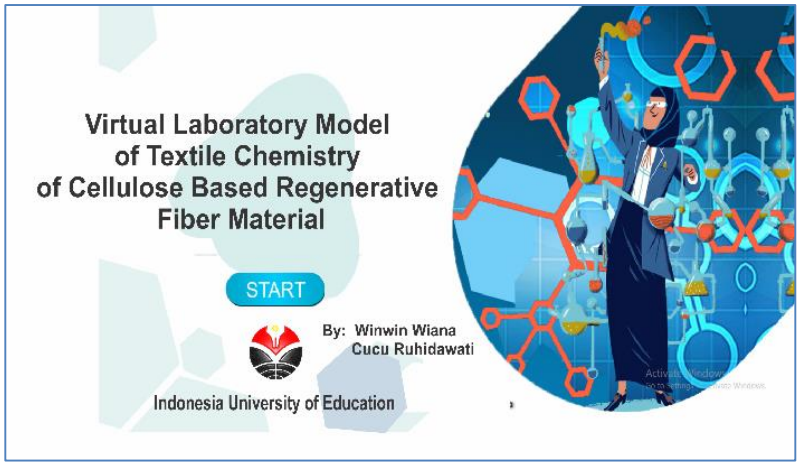


Figure 2. Welcoming Slide of Virtual Textile Chemistry Laboratory

Figure 3. Home Menu of Virtual Textile Chemistry Laboratory

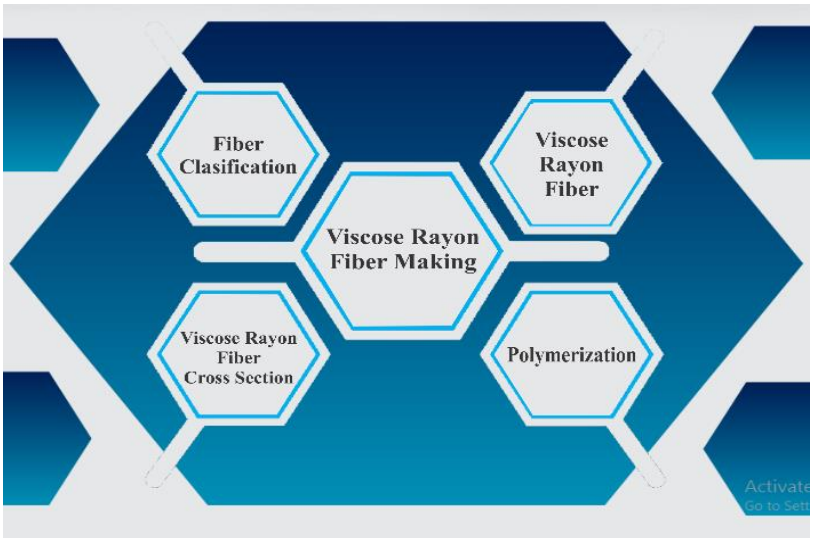


Figure 4. One of the Virtual Textile Chemistry Laboratory Content (The making of Liquid mixture of Viscose on Alkalinity Process)

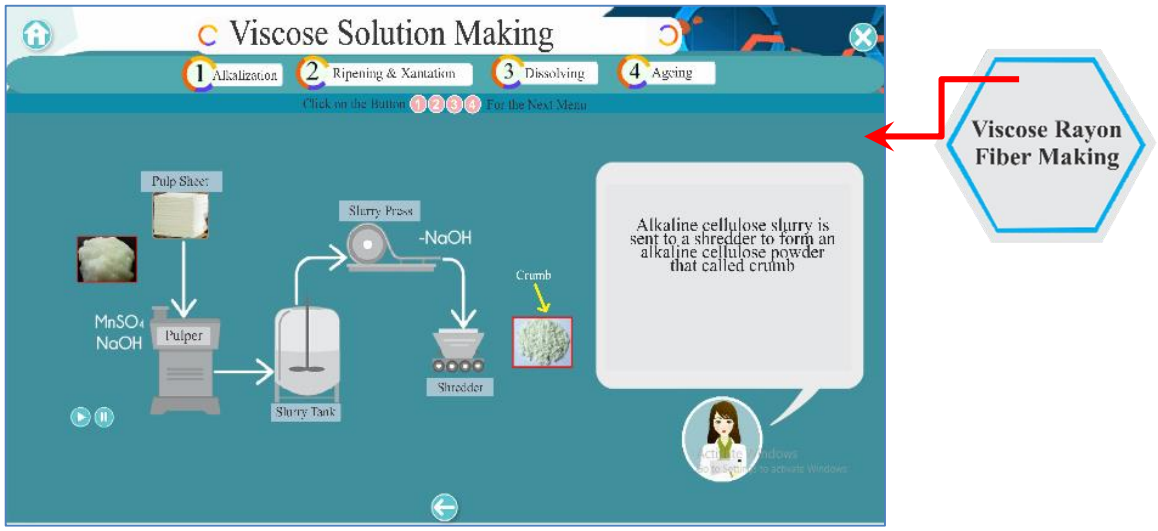
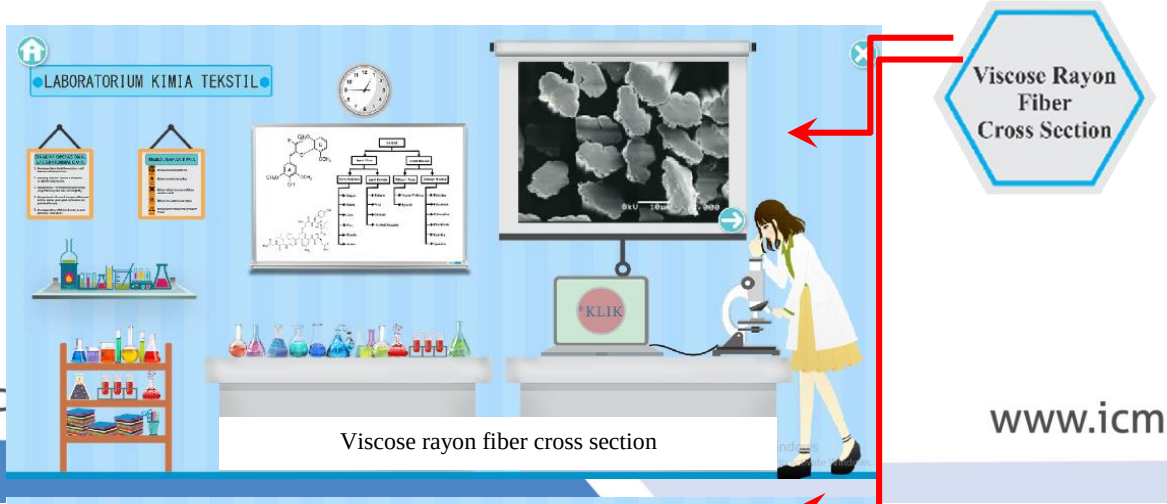


Figure 5. One of the Virtual Textile Chemistry Laboratory Feature (Simulation of rayon Viscose)



2. **Methodology**

The research method used in this study was a survey with a questionnaire technique to capture student perceptions. The subjects of the study were 45 students of the Universitas Pendidikan Indonesia majoring Fashion Design and Education batch 2017. Textile Chemistry learning is carried out with a modified free inquiry strategy that integrates the use of virtual laboratories. The questionnaire was filled out by students after the end of the Textile Chemistry course. The Virtual Laboratory application has been developed in a previous R&D study. The research instrument used is a Likert scale questionnaire which consists aspects of innovation, motivation, effectiveness and benefits on the use of Virtual Chemistry Textile Laboratory in learning making cellulose-based regenerative fibers, which are translated into positive and negative statements. The answer choice scale on the questionnaire consisted of 4 scales, namely 'Strongly Agree', 'Agree', 'Unlikely to Agree', and 'Disagree'. Logical validation of the questionnaire was conducted by lecturers in the field of Chemistry and Textile Technology. The questionnaire specification can be seen in the following table:

Table 1. Students' Perception Questionnaire Specification

No	Perception	Statement		No of Question	Total Item
		Positive	Negative		
1.	Innovation	1	1	1, 2, 3	3
2.	Motivation	1	1	4, 5	2
3.	Easiness	1	1	6, 7, 8	3
4.	Benefit	1	1	9, 10	2
Total		5	5		10

Source: Data Processing Result

Table 1 in advance is used to measure students' perceptions of their experience using virtual laboratory devices in textile chemistry on cellulose-based regenerative textile fiber making materials. Statement indicators are made in a positive and negative format, it is intended to look deeper and more objectively about the tendency of their assessment of the existence of such virtual laboratory devices in support of their learning activities.

3. **Findings and Discussion**

Based on this specification, statements are made in accordance with established aspects of perception. The scoring method in processing the questionnaire data is for positive statements, the scale of 'Strongly Agree' has a score of 4, 'Agree' has a score of 3, 'Unlikely to Agree' has a score of 2, and 'Disagree' score is 1. Whereas for a negative statement the scale of 'Strongly Agree' has a score of 1, 'Agree' has a score of 2, 'Unlikely to Agree' has a score of 3, and 'Disagree' has a score of 4. Furthermore, the same score on each statement is calculated and expressed according to the following equation:

P = Percentage of each scale (%)

S = Number of the same score

N = Number of respondents Perception Interpretation for percentage result of positive statements percentage are 'Strongly Agree' equals with (4) and 'Agree' (3) is summed up

and interpreted as positive perception, while the percentages of the 'Unlikely to Agree' (2) and 'Disagree' (1) are summed up and interpreted as negative perceptions. Whereas for negative statements, the percentage of the scale of 'Strongly Agree' (1) and 'Agree' (2) is summed up and interpreted as negative perceptions, while the percentages of the scale of 'Unlikely to Agree' (3) and 'Disagree' (4) are added and interpreted as positive perception.

Based on the results of data collection in the form of filling questionnaires by students regarding their perceptions of the use of Virtual Textile Chemistry Laboratory on learning making cellulose-based regenerative fibers, the analysis of students' perceptions is based on the results of an analysis of the questionnaire scores that have been processed which can be seen in Table 2 below:

Table 2. Recapitulation of Students' Perception

No	Component of Perception	Persentage of Perception (%)		Total (%)
		Positive	Negative	
1.	Innovation	94	6	100
2.	Motivation	89	11	100
3.	Easiness	90	10	100
4.	Benefit	87	13	100
Average		90,75	9,25	100

Source: Data Processing Result

Based on Table 2 it can be seen that most of the students (90.75%) have positive perceptions of the use of Virtual Laboratory in Molecular Biology learning, and a small number of students (9.25%) have negative perceptions. The highest percentage of positive perceptions based on respondents' answers was in the aspect of innovation. These conditions indicate that students perceive that a virtual laboratory device that is developed has novelty and innovation. In other aspects of student perceptions are also high; this means students also have high positive thinking on Virtual Textile Chemistry Laboratory.

3.1 Innovation Aspect

Related to the innovation aspect of the Virtual Textile Chemistry Laboratory (VTCL), as many as 94% of students thought that the use of these devices in learning Textile Chemistry was an innovative step as they were doing it for the first time, while 6% of other students thought that the device was not an innovation, because in various parts of the world similar devices have been developed for various learning media.

When the term virtual laboratory was introduced, most of the students looked very enthusiastic; the explanations presented by VTCL through the simulations were interesting in their appearance. It evokes students' enthusiasm in listening to the learning material of the making of the cellulose-based regenerative textile fibers. This condition is in line with the results of research conducted by Suryanti et al [15] who found that practicum can be done on a computer is a new experience for student respondents, so most of them have a positive perception of the use of virtual laboratory equipment. Apart from Shegog, et al. [13] he found

that students are positive about the use of computer simulations in learning 'Procedures for constructing genes', because simulations can provide positive learning experiences.

3.2 Motivation Aspect

Motivation aspects demand students' opinions regarding their interest in the use of VTCL in learning making cellulose-based regenerative textile fibers in the Chemistry Textile course. The results of the questionnaire data analysis showed that 89% of students stated that they were motivated and 11% of the students were unmotivated and tended to be confused. This meant that most students felt motivated by using VTCL as a learning media. This finding is in line with the results of the research conducted by Adi et al [1] he found that his Virtual Laboratory trial in increasing student motivation reveals that Virtual Laboratory has a significant effect ($p = 0.0000$) on student motivation. Apart from what Havlíčková, et al. [6] revealed that biology teachers and prospective biology teachers are equally motivated by hands-on and virtual dissection activities on the subject of Anatomy. However, it is different from Špernjak and Šorgo, [14] who found that based on the three types of laboratory work, the Virtual Laboratory was least liked by students.

The VCTL media used in learning making cellulose-based regenerative textile fibers is designed to support free inquiry learning where students are required to actively seek knowledge and information from various learning resources to fulfill their competence and knowledge about cellulose-based regenerative fibers. Therefore, previous learning activities on virtual cellulose-based regenerative fiber making materials that should be done is the students should try to learn the concepts and making procedures of cellulose-based regenerative fiber, so that the simulation presented by VCTL becomes a media to strengthen their concepts, insights and knowledge about making of cellulose-based regenerative textile fibers.

3.3 Easiness Aspect

This statement about the convenience aspect is to raise students' thoughts about how they operate the VCTL device in their learning process. The students have a big number of opportunities in learning making of cellulose-based regenerative textile fibers outside the classroom. VCLT helps the students, so they can open learning sessions whenever and wherever they can. Therefore, the easiness in operating this device is important. Based on the opinion of the students who have used this tool to study independently outside of lecture hours, the data obtained that 90% of students perceive that the development of VCTL device meets the aspects of ease of operation; this can be concluded that most of students find it easy to operate the device. In this aspect there are some students (10%) who have negative perceptions. It means that some students think that VCTL devices are ineffective and inefficient for their learning process, the possible reason of this situation is the students encounter some difficulties in operating VCTL devices. This condition is in line with the opinion of Schnotz and Lowe [12] which states that the use of animation does not always function as an effective tool for learning.

3.4 Benefit Aspect

Student perceptions of the benefits aspect are to reveal how the benefits of using the LVKT tool in their learning process on the material for making cellulose-based regenerative textile fibers, and based on the data collection process, 87% of students perceive that the VTCL device provides positive benefits. This can be interpreted that most of the students felt the benefits of using the VTCL tool, where the device could facilitate them in understanding the concept of making cellulose-based regenerative textile fibers, while the other 13% expressed confusion, and the device did not provide significant benefits to their learning activities. The possible reason of this condition is they have difficulty in operating VTCL devices (the convenience aspect is relevant), so they have difficulty in getting information (material content) from the learning activities they do.

Many research articles discuss the benefits of using virtual media including Virtual Laboratory, for example Nirwana [11] who states that through virtual laboratories the learning process becomes more interesting, more interactive, the amount of teaching time can be reduced, the quality of learning can be improved and the process teaching and learning can be done anywhere and anytime. Another commitment to note is that virtual media can increase student creativity, similarly Gunawan et al. [5] argue that scientific work skills are higher in students who learn with guided inquiry assisted with virtual laboratories than students who learn conventionally. Whereas Dyrberg, et al [4] revealed that the acquisition of knowledge using virtual laboratories is better than science classes without visualization elements of virtual laboratories.

4. Conclusions

Based on data analysis and discussion it can be concluded that most of students have positive perceptions about the use of VTCL applications in learning making cellulose-based regenerative textile fibers in the Textile Chemistry course, although a small percentage of students have negative perceptions. These findings can be used as a basis for further virtual Laboratory application development as an alternative in creating more interesting learning, help students to improve their concept mastery, and overcome the limitations of laboratory facilities.

Acknowledgments

Thank you to :

1. Kemenristek Dikti
2. The Institute of Research and Community Service, Universitas Pendidikan Indonesia
3. Faculty of Technology and Vocational Education, Universitas Pendidikan Indonesia
4. Programme Study of Fashion Design Education, Universitas Pendidikan Indonesia

Authors' Contribution

This journal is part of requirements and outcomes of research funded by Kemenristek Dikti.

Funding
Data collection is funded by Kemenristek Dikti.

Availability of data and materials
Not applicable.

Competing Interest
The authors declare that they have no competing interests.

Author details
[1]Programme Study of Fashion Design Education, Universitas Pendidikan Indonesia, Bandung 40154, Indonesia.

REFERENCES

[1] Adi.W.C, uratno, Iqbal. M, (2015), *Development of A Virtual Laboratory on Topic Excretory System to Improve Learning Motivation of Students XI Grade at State Senior High School 2 Bondowoso,* Artikel Ilmiah Mahasiswa Vol 1 No.1

[2] Ayas, A. & Demirbas, A. (1997). Turkish Secondary Students' Conceptions of Introductory Chemistry concepts, *Journal of Chemical Education* 745, 518–521.

[3] Dwiningsih.K, Sukarmin, Muchlis, Rahma.P.T, (2018), Developing Chemical Instructional Media Using Virtual Laboratory Media based on the Global Era Learning Paradigm, *Jurnal Teknologi Pendidikan* Vol: 06/02 Desember2018

[4] Dyrberg, N. R., Treusch, A. H., & Wiegand, C. (2016). Virtual laboratories in science education: Students' motivation and experiences in two tertiary biology courses. *Journal of Biological Education*, doi: http://dx.doi.org/10.1080/00219266.2016.1257498

[5] Gunawan, G., Setiawan, A., & Widyantoro, D. H. (2013). Model Virtual Laboratory Fisika Modern untuk Meningkatkan Keterampilan Generik Sains Calon Guru, *Jurnal Pendidikan dan Pembelajaran* (JPP), 20(1), 25-32.

[6] Havlíčková, V., Šorgo, A., Bílek, M. (2018). Can Virtual Dissection Replace Traditional Hands-on Dissection in School Biology Laboratory Work? EURASIA *Journal of Mathematics, Science and Technology Education,* 14(4), 1415-1429. doi: https://doi.org/10.29333/ejmste/83679

[7] Herga, N. R., Dinevski, D. (2012, June). *Using A Virtual Laboratory to Better Understand Chemistry-An Experimental Study on Acquiring Knowledge. In Information*

Technology Interfaces (ITI), Proceedings of the ITI 2012 34th International Conference on (pp. 237- 242). IEEE

[8] Kumar, A. Pakala, R., Ragade, R. K., & Wong, J. P. (1998). *The Virtual Learning Environ-ment System.* Paper presented at the IEEE Computer Society, FIE Conference, CA, USA.

[9] Oidov, L., Tortogtokh, U., & Purevdagva, E. (2012). *Virtual Laboratory for Physics Teaching. In International Conference on Management and Education Innovatio,* IPEDR Vol. 37, pp. 319-323.

[10] Rajendran.L, (2010), A Study On The Effectiveness of Virtual Lab in E-learning, *International Journal on Computer Science and Engineering* Vol. 02, No. 06, 2010, 2173-2175

[11] Nirwana.R.R, (2011), *Pemanfaatan Laboratorium Virtual dan E-Reference dalam Proses Pembelajaran dan Penelitian Ilmu Kimia*, publication at: https://www.researchgate.net/publication/327200206

[12] Schnotz, W., & Lowe, R. (2003). *External and internal representation in multimedia lear- ning. Learning and Instruction,* 13, 117–123. doi: https://doi.org/10.1016/S0959-4752(02)00015

[13] Shegog, R., Lazarus, M. M., Murray, N. G., Diamond, P. M., Sessions, N., & Zsigmond, E. (2012). *Virtual transgenic: Using a molecular biology simulation to impact student academic achievement and attitudes*. Res. Sci. Educ., 42, 875-890. doi: https://doi.org/10.1007/s11165-011-9216-7

[14] Špernjak, A., & Šorgo, A. (2017). Differences in acquired knowledge and attitudes achieved with traditional, computer-supported and virtual laboratory biology laboratory exercises. *Journal of Biological Education*. doi: https://doi.org/10.1080/00219266.2017.1298532

[15] Suryanti.E, Fitriani.A, Redjeki.S, Riandi, (2019), Persepsi Mahasiswa terhadap Penggunaan Virtual Laboratory dalam Pembelajaran Biologi Molekuler, *Journal of Natural Science and Integration* Vol. 2, No. 2, Oktober 2019.

[16] Woodfield, B. (2005). *Virtual Chemlab Getting Started*. Pearson Education website. Retrieved May 25, 2005, from http://www.mypearsontraining.com/pdfs/ VCL_getting_started.pdf.