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Evaluation of the program for modeling and implementation of a virtual laboratory for solid-state electronics

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ABSTRACT

Teaching and learning process during the COVID-19 pandemic especially in practical courses which were initially face-to-face turned into online mode. This change had several impacts on lecture activity, especially in terms of skill and the learning outcomes towards the quality of graduates. Therefore, it is essential to evaluate this learning process by using the CIPP model developed by Stufflebeam. This evaluation model aims to find out how effective ways the use of virtual laboratories is in learning practical online courses. This research is evaluative research using a qualitative descriptive approach where the data used qualitative data with analytical methods. The technique used in this study is to examine existing data using grounded research methods. The results showed that there is the largest percentage, namely the use of virtual laboratories has been quite effective in online learning during the COVID-19 pandemic, with the improvement, and development of media and learning models that are more innovative and creative. In addition, efforts in skills that directly deal with equipment still need to be fulfilled in real laboratories to increase enrichment and deeper understanding and skills in work procedures in the job market later.

Keywords: CIPP Model, Virtual laboratory, COVID-19 Pandemic, Practice, Solid-State Electronics

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INTRODUCTION

The COVID-19 pandemic outbreak has forced changes the habits in all fields including the education sector where the learning process conducted face-to-face is currently carried out online. This change in teaching and learning activities demands the development of the world of education along with the development of the world of information technology in the globalization era. This was done to improve the quality of education, namely the quality of the teaching and learning process (Baharudin, 2010).

As experienced by the Aviation Polytechnic of Surabaya point of view at this time, there was a percentage of practical credits of 70% and theory of 30%, new challenges for practical courses in preparing to change from a real to a virtual laboratory, especially in the D3 Air Navigation

Engineering Study Program. In reality, various institutions, and educational institutions are trying to build internet networks and procure software, and hardware infrastructure, all of which are to fulfill efficient and effective learning (Budiman, 2017). The great hope is that learning outcomes in practical courses when online learning can be achieved.

According to (2011), a model means a pattern, plan, or example of something to be made and was done, or produced (Ismanto, 2014) evaluation is the process of describing, obtaining, and providing information that is useful for assessing alternative decisions. The evaluation uses data from measurements and assessments. Measurement results are expressed as scores or numbers, which are evaluated and interpreted according to guidelines to verify an individual's aptitude. The level of success of an individual or a learning program is then determined by analyzing the results of this assessment process.

(Djaali & Pudji, 2008) explained that evaluation is a methodical process used to determine the extent to which set goals have been achieved. (Wirawan, 2011) stated that the evaluation model serves as a framework for conducting the assessment and a method for gathering and using data to ensure that information is acquired accurately enough and that the evaluation's goals may be met. What needs to be done and how the assessment model dictates how the evaluation process is conducted the four assessment kinds of Context, Input, Process, and Product must be completed by evaluators if they select the CIPP model evaluation.

(Syahid Akhmad, 2018) stated and planned the systematic process of collecting data on attitudes, knowledge, and abilities related to student learning outcomes is carried out to monitor learning progress and improve learning outcomes. Learn through activities and evaluate learning results what Syahid describes as the assessment of learning outcomes by educators. (Triwiyanto, 2015) said that in the context of the curriculum, curriculum assessment is a series of activities that compares the implementation of inputs, processes, outputs, and outcomes to curriculum and standards.

(Nasution, 2010) declared that educational evaluation is the process of providing or procuring information that is useful for making decisions in the field of education. This also means that the assessment is a provider of information, not a decision-maker. In principle, the CIPP model is used for educational evaluation (Muri Yusuf, 2017). The CIPP assessment method is the method most used and recognized by assessors (Arikunto, 2010). Therefore, compared to other models, the description provided is a bit long. From Ohio State University (OSU), Stufflebeam created the CIPP model. The acronym CIPP is made up of the first letters of the following four words: process, input, context, and product assessment, stands for context assessment, input assessment enters, and evaluation of the results. The four terms that make up the acronym CIPP relate to assessment objectives, which are essentially milestones in the implementation of a program of activities. In other words, the CIPP model is an evaluation technique that looks at the entire program. Therefore, the evaluation team will certainly have to analyze each program component if it has chosen to apply the CIPP model to evaluate a certain program. Context assessment is the process of

providing data to help an organization set clearly defined goals, create an appropriate climate, and identify problems related to programs, learning activities, and educational activities. (Purwanto & Si, 2011) expressed that context evaluation is a situation or background that influences the types of educational goals and strategies.

The purpose of input evaluation is to provide the solution to the problem of what to do. This assessment seeks to help decision-makers identify goals and priorities. It also helps a broader user base evaluate program goals, benefits, and priorities and alternative strategies, action plans, team plans, and target budgets. It conveys input evaluation components including students, curriculum, teaching materials, teachers, and learning facilities (Bhakti, 2017).

Mulyani said the purpose of the system, the equipment used, the manufacturer and method of implementing the system, and the characteristics of the student and environment all influence the success of the educational system. This is the belief of the CIPP assessment model, which has a broader scope (Mulyani, 2017). The CIPP model has several additional advantages over other assessment models. First, it is more comprehensive than other models because it takes into account context, inputs, processes, and outcomes in addition to the outcomes themselves. It presents the disadvantages of the CIPP method alongside its advantages. Among these other factors, the level of implementation of this model in the classroom learning curriculum area will be less than when used without change. This is possible because a comprehensive assessment of context, inputs, and outcomes will involve more stakeholders and require additional costs and time (Widiyoko, 2009).

Online learning is distance learning (PJJ). In short, the development of distance education can be classified according to the dominant technology used. (Taylor, 2001). For example, divide the distance learning generation into five (5) generations: (1) learn by letters; (2) multimedia learning; (3) distance learning; (4) flexible learning; and (5) smarter flexible learning model (smart flexible learning model).

The virtual laboratory can be thought of as an interactive playground where users can design and perform simulation experiments. It consists of a reference work, a testing unit called an object containing data files, tools for working on the objects, and a domain-dependent simulation program (Angelescu et al., 2003). Static websites containing text and video can be used as virtual labs to enhance teaching and learning, as can dynamic websites with complex settings, collaborative authoring, video-on-demand, virtual meetings, and more (Emigh & Herring, 2005). In particular, it is estimated that the availability of this virtual laboratory will allow students to carry out internships with or without an internet connection, thus eliminating the need for their physical presence during internships in real laboratories. Since students can learn actively without the help of a teacher, like a running machine, it becomes an effective form of teaching full support is provided through a web-based or app-based presentation format to enable students to engage in internships on their own. (Puspita & Yamin, 2008). The virtual laboratory used in solid-state

electronics learning here is the Proteus application. Here students can design electronic circuits without fear of errors occurring, for example, burning, short circuits, over current, etc.

Learning outcomes are the overall results of the learning process carried out in various circumstances. Learning outcomes are defined as all effects that can be used as indicators of the value of using learning methods under different conditions (Degeng & Sudana, 2013). Learning outcomes are interpreted as the achievement of various aspects of competence in the learner after going through the learning process (Budyartati, 2014). The achievement of this competency can be in the form of an increase in the aspects of skills, knowledge, attitudes, and value awareness that can be observed in the form of changes in mindset and behavior that are different in the learner when compared to before taking the learning process.

Here the researcher evaluates online learning based on a virtual laboratory in practical courses using the CIPP Model (Context, Input, Process, and Product). With the limitations of the researchers here, they focused on the Solid-State Electronics Practice Course in the D3 Air Navigation Engineering Study Program at the Aviation Polytechnic of Surabaya. Based on the background of the research above, the researcher formulated the problem as follows:

How to evaluate virtual laboratory-based online learning in the Solid-State Electronics practical course using the CIPP Model in the D3 Air Navigation Engineering Study Program?

METHOD

The purpose of this study was to gain experience using a virtual laboratory in practical learning of the Solid-State Electronics course from the perspective of students, teachers, and the D3 Air Navigation Engineering study program. This research is evaluation research. The evaluation model used is the CIPP (Context, Input, Process, and Product) evaluation model. Judging from the source data and types of data collected, this research uses a quantitative research approach. This quantitative approach is used to explain the facts that can be measured quantitatively CIPP (Context, Input, Process, and Product) evaluation model developed by Stufflebeam is used in learning (Stufflebeam, 2003). This study uses a qualitative research methodology. The following in Table 1 can be categorized through CIPP evaluations in the use of virtual laboratories during online learning.

Table 1. CIPP evaluation instrument

No.	Variable/Indicators	Mark	Criteria
A	***Context* Aspects**		
1	Learning objectives of practical Courses		
2	The learning environment at home		
3	Cadet style and characteristics		

4	The relationship between learning objectives and online learning
5	Teaching materials support online learning
B	***Input* Aspects**
1	Early knowledge of cadets
2	Creative in the learning process
3	Cadet's behavior
4	Concentration on practical material
5	Learning Resources
6	Facilities and infrastructure
7	Instructional Media
C	***Process* Aspects**
1	Conformity of the RPS with the implementation
2	Online teaching and learning take place
3	Diversity of learning models
4	Learning materials by the RPS
D	***Product* Aspects**
1	The expected abilities after attending online lectures through a virtual laboratory
2	There was a positive response from the cadets
3	There was a positive response from the lecturer
4	Practice skills increasingly
5	The online learning model is a model for implementing MBKM

The research instrument uses an online learning evaluation instrument based on a virtual laboratory in practice courses with the CIPP model which used and applied the criteria according to Table 2 below.

Table 2. Percentage range and criteria

No	Interval	Criteria
1	0% < percentage ≤ 25%	Poor

2	26% < percentage ≤ 50%	Inappropriate
3	51% < percentage ≤ 75%	Appropriate
4	76% < percentage ≤ 100%	Very Appropriate

RESULTS AND DISCUSSION

From the context aspects in instrument table 1 above, the data results have been reduced, concluded, and presented in the graph of Figure 1 below which can be concluded that the average of the five indicators in the context aspects is 78.6, and considered as very appropriate. Meanwhile, in this context aspects, there is input for the need for guidance to parents and the home environment regarding understanding study hours, learning conditions and characteristics, and availability of internet networks.

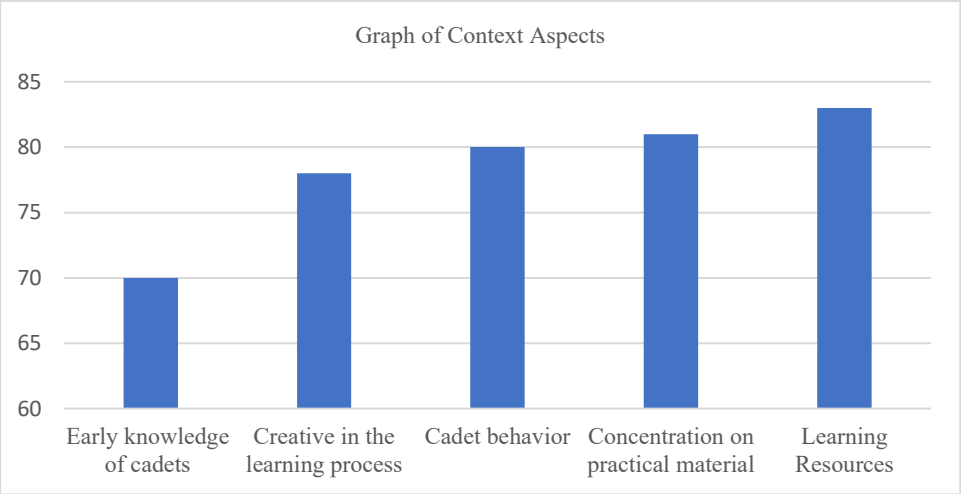

Figure 1. Graph of Context Aspects

From the input aspects of the instrument table 1, the results of the data have been reduced, concluded, and presented in the graph of Figure 2. It can be concluded that the average of the five indicators on the input aspects is 79.57 and considered very appropriate. On the initial knowledge indicator, cadets get a score of 70 considered appropriate because the Solid-State Electronics course was given in semester 1. Moreover, initial knowledge is needed from real forms of both components, measuring instruments, and trainers with the initial meeting in a real laboratory that conveys real conditions, it is hoped ways to improve subsequent learning outcomes used in the virtual laboratories.

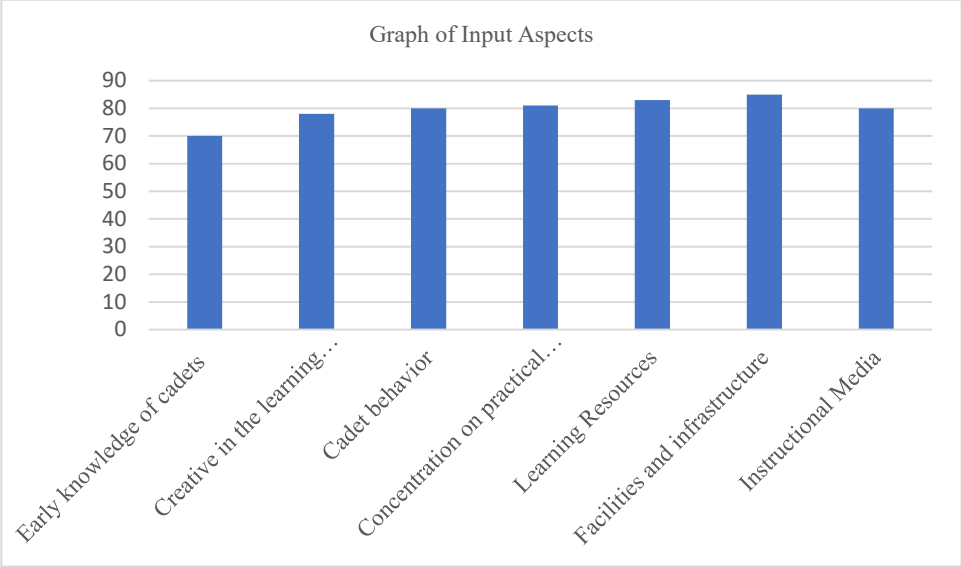

Figure 2. Graph of Input Aspects

From the input aspects in the instrument table 1 above, the data results have been reduced, concluded, and presented in the graph of Figure 3. It can be concluded that the average of the five indicators in the process aspects is 80.5, considered as very appropriate whereas the indicator of the diversity of learning models gets a value of 73 considered as appropriate. Various kinds of learning models need to be tried in the implementation of virtual laboratories, for example, project-based and problem-based learning, etc.

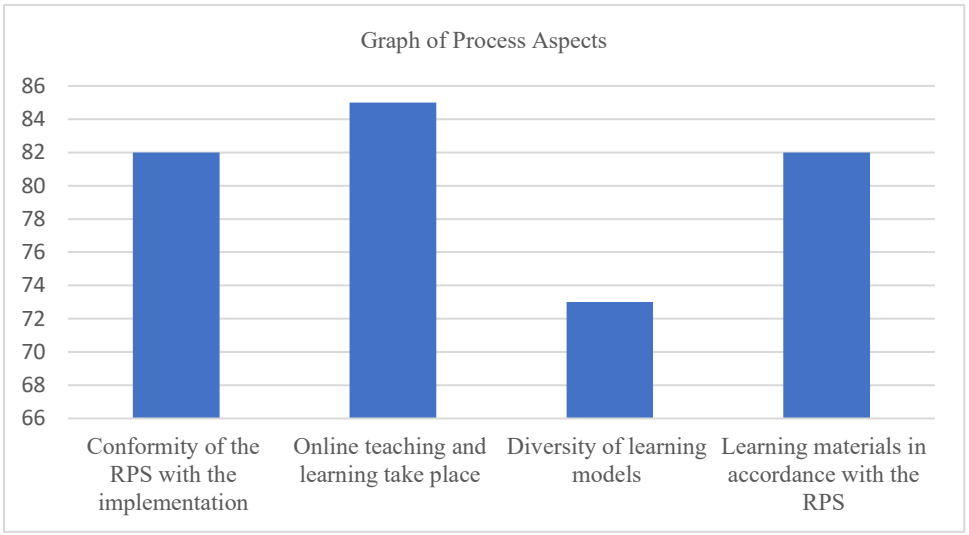

Figure 3. Graph of Process Aspect

From the input aspects of the instrument table 1 above, the results of the data have been reduced, concluded, and presented in the graph of Figure 4. It can be concluded that the average of the five

indicators on the product aspects is 82.8 which is considered very appropriate. Further, as represented in the picture below, it can be seen that practical skills have the highest score in a total of 87 because, in the virtual laboratory, students can do practicum anywhere, at any time, and repeatedly. So, they do not need to go to a real laboratory to improve their skills in Solid-State electronics practicum.

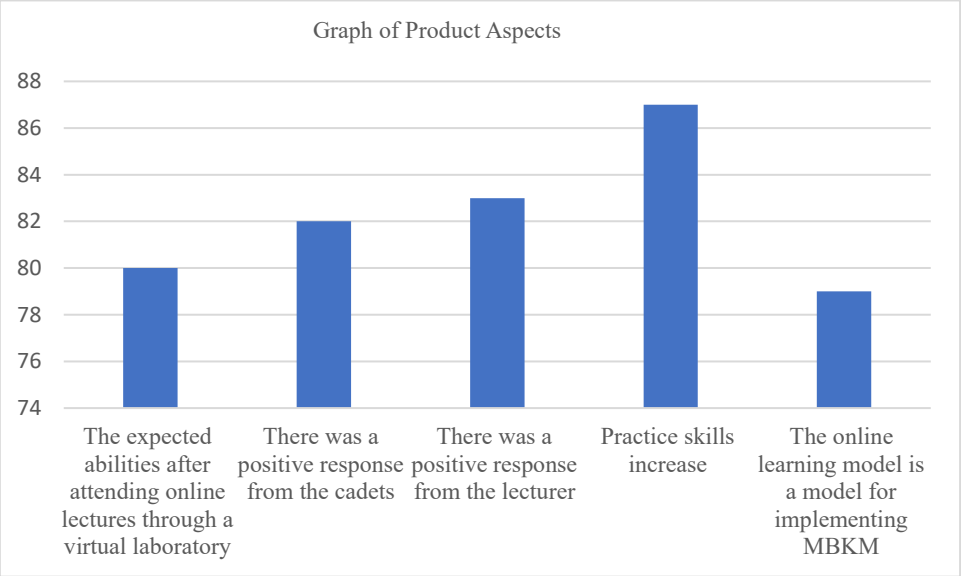

Figure 4. Graph of Product Aspects

CONCLUSION

Evaluation for the use of the CIPP model effectively which consists of (Context, Input, Process, and Product) in the virtual laboratory through online learning with the Solid-State Electronics practical course got an average of 80.4 which is considered very appropriate in several inputs. The need for development is also included in the indicators of learning model diversity with a total value of 73 and considered as appropriate. In the initial knowledge indicator, cadets get a value of 70, which means appropriate. As well as on indicators the linkage of learning objectives with online learning in the input context gets a value of 75 and is considered as appropriate. From the 4 aspects of each indicator, some need to get top priority in repair and improvement, because there are still have 3 items with appropriate criteria. The research suggestions are more in the improvement indicators with the appropriate ones and consisting of the process aspect with indicators of the diversity of learning models, it is necessary to improve by trying various learning models (1) in the input aspects with the initial knowledge indicator for cadets, it is necessary to introduce components, measuring instruments and trainers at the beginning of learning (2) on indicators linkage of learning objectives with online learning on context aspects, it is necessary to update methods, strategies and techniques in learning.

REFERENCES

Angelescu, A., Kleps, I., Mihaela, M., Simion, M., Neghina, T., Petrescu, S., Moldovan, N., Paduraru, C., & Raducanu, A. (2003). Porous Silicon Matrix for Application in Biology. In *Rev.Adv.Mater.Sci* (Vol. 5).

Arikunto, S. (2010). *Evaluasi Program Pendidikan*. PT Bumi Aksara.

Baharudin, R. (2010). Keefektifan Media Belajar Berbasis Teknologi Informasi dan Komunikasi. *Tadrîs*, *5*(1), 112–127.

Bhakti, Y. B. (2017). Evaluasi Program Model CIPP pada Proses Pembelajaran IPA. *JIPFRI (Jurnal Inovasi Pendidikan Fisika Dan Riset Ilmiah)*, *1*(2), 75–82. https://doi.org/10.30599/jipfri.v1i2.109

Budiman, H. (2017). Peran Teknologi Informasi Dan Komunikasi Dalam Pendidikan. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, *8*(1), 31. https://doi.org/10.24042/atjpi.v8i1.2095

Budyartati, S. (2014). Problematika Pembelajaran di Sekolah Dasar. In *Jurnal Inspirasi Pendidikan (ALFIHRIS)* (Issue 2). Deepublish.

Degeng, N. S., & Sudana, N. (2013). *Ilmu Pembelajaran: Klasifikasi variabel untuk pengembangan teori dan Peneltian*. Kalam Hidup.

Djaali, H., & Pudji, M. (2008). *Pengukuran dalam Bidang Pendidikan* (S. Y.B, Ed.). Grasindo.

Emigh, W., & Herring, S. C. (2005). Collaborative authoring on the web: A genre analysis of online encyclopedias. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 99. https://doi.org/10.1109/hicss.2005.149

Ismanto, I. (2014). Evaluasi Hasil Belajar Pendidikan Agama Islam (PAI). *Edukasia : Jurnal Penelitian Pendidikan Islam*, *9*(2), 211–236. https://doi.org/10.21043/edukasia.v9i2.773

Mulyani, S. (2017). Penggunaan Media Kartu (Flash Card) dalam Meningkatkan Hasil Belajar Konsep Mutasi bagi Peserta Didik Kelas XII. *Jurnal Profesi Keguruan*, *3*. https://journal.unnes.ac.id/nju/index.php/jpk

Muri Yusuf, A. (2017). *Asesmen dan evaluasi pendidikan: pilar penyedia informasi dan kegiatan pengendalian mutu pendidikan*. Predanamedia Group.

Nasution, Z. (2010). *Manajemen Humas di Lembaga Pendidikan*. Universitas Muhammadiyah Malang Press.

Purwanto, R., & Si, S. (2011). Peningkatan Motivasi dan Hasil Belajar Siswa Pada Kompetensi Sistem Koordinasi Melalui Metode Pembelajaran Teaching Game Terhadap Siswa Kelas XI IPA SMA Smart Ekselensia Indonesia Tahun Ajaran 2010-2011. *Jurnal Pendidikan Dompet Dhuafa Edisi I*, *1*, 1–14.

Puspita, R., & Yamin, M. (2008). Sistem Informasi Aplikasi Virtual Lab Pada Laboratorium Sistem Informasi Universitas Gunadarma. *Seminar Ilmiah Nasional Komputer Dan Sistem Intelijen (KOMMIT 2008)* , 190–198.

Stufflebeam, D. L. (2003). The CIPP Model for Evaluation. In *Evaluation Models* (pp. 279–317). Kluwer Academic Publishers. https://doi.org/10.1007/0-306-47559-6_16

Syahid Akhmad. (2018). Komponen Evaluasi Pembelajaran Bidang Studi Pendidikan Agama Islam dan Budi Pekerti. *Jurnal Teknologi Pendidikan Madrasah*, *1*(1), 33–52. https://doi.org/DOI: 10.5281/zenodo.1148975

Taylor, J. (2001). Fifth Generation Distance Education. *Instructional Science and Technology*, *4*, 1–14. https://research.usq.edu.au/download/5da9a584b54ec7d23cfdd8bcd3b723e6f38c3f32bf4892e990e99708f8555df1/131880/Taylor.pdf

Triwiyanto, T. (2015). *Manajemen Kurikulum Dan Pembelajaran* (Y. N. I. Sari, Ed.). PT Bumi Aksara.

Widiyoko, P. E. (2009). *Evaluasi Program Pembelajaran*. https://scholar.google.co.id/citations?view_op=view_citation&hl=id&user=vB0UsJsAAAAJ&citation_for_view=vB0UsJsAAAAJ:qjMakFHDy7sC

Wirawan, W. (2011). *Evaluasi Teori Model Standar Aplikasi dan Profesi*. Rajawali Pers.