

Validity and Practicality of E-Module Microtic Training toward Computer Network Engineering Teachers

Rusdinal^a, Kasman Rukun^b, Asrul Huda^c, Khairul Anshari^d,
^{a,b,c,d}Universitas Negeri Padang, Email: ^arusdinal@fip.unp.ac.id,
^bkasman.rukun@gmail.com, ^casrulhuda@gmail.com,
^danshari_khairul@yahoo.co.id

This research developed training microtic e-modules and reveals their validity and practicality utilising the Plomp and Nieveen models that included three stages of development: preliminary research, prototyping stage, and assessment stage. The instrument used was a questionnaire on validity and practicality. The results of the validity test researched by 3 material experts were from 3 aspects including the construction and technical aspects which were obtained from validator 1 with an average of 0.92, from validator 2 with an average of 0.87, and of validator 3 with an average of 0.89 within validity category. Based on these results from the 3 validators the average validator was 0.893 within validity category. In the validation of the material of 3 e-module experts with the 4 aspects of content quality, learning quality, interaction quality, and display quality, validator 1 showed an average of 0.84, , validator 2's average was 0.83, and validator 3 average is 0.82 within validity category. Based on these results the material validation obtained an average of 0.83. Based on practicality tests by computer engineering teachers at SMK N 2, SMK N 3, SMK N 5, SMK N 6 and SMK N 8 Padang, this e-module has a very high practicality category at 80.31%. Based on the results of this study, it can be concluded that the microtic training e-module is validated by experts and practically by instructors and trainees.

Key words: *E-Module, Microtic, Training, Validity, Practicality.*

Introduction

Based on results of National Teachers' Test (*Uji Kompetensi Guru*) in 2015, the national average of 50.97 was obtained whereas the national standard by government is 55.00. This showed the lack of teacher competence nationally that needs to be improved upon in order to

achieve national learning goals (Tobari et al, 2018). Based on observations in the field on computer network engineering (TKJ), there were 20 teachers' needing training, in microtic, cisco, optical fibre, network administration, softswitch and IP V6; 20 teachers needed training in software engineering (RPL); 29 teachers needing training a in android, web, and java; 12 teachers needing training on Android, and in multimedia field (MM); 18 teachers needing training in graphic design, filmmaking and picture taking; and 18 teachers needing training in animation (Fitria et al, 2019).

Table 1: Vocational School Observation Results of Informatics department in West Sumatra

Field of Experience	Material Required	Total	
<i>TKJ FIELD</i>	Microtic	20	People
	Cisco	18	People
	Fibre optic	15	People
	Network administration	5	People
	Soft switch	5	People
	IP V6	4	People
<i>RPL FIELD</i>	Android	12	People
	Web	10	People
	Java	7	People
<i>MM FIELD</i>	Animation 2D, 3D	18	People
	Graphic Design	10	People
	Filming	6	People
	Shooting	2	People

Based on observations results, teachers of network computer engineering need microtic training. Microtic e-module was researched to carry out microtic training. Lack of microtic e-modules was in the display of material such as PowerPoint with pdf format, so that it was only displaying the core material, without explaining in more detailed the work steps, teachers usually use internet resources to be used as job sheets, lack of material regarding troubleshooting on the microtic network, installing network and proxy on microtic, and e-module still contains old material that has not been updated with current situation.

Now we are facing the fourth industrial revolution, known as the industrial revolution 4.0 (Griffiths & Ooi, 2018). This revolution involves an era of disruptive innovation – development is so rapid in that it impacts by creating a new market that disrupts or damages existing markets by replacing existing technologies. This digital age not only has an impact on the field of industry, but also affects all aspects of human life in the world without exception, including the world of education (Chinoracký & Čorejová, 2019).



Facing the great challenges of the industrial revolution 4.0, education is required to change because we are only given two choices, namely change or die (Lase, 2019). This includes education at the primary and secondary levels. The area of education which is influenced by the industrial revolution 4.0 is called Education 4.0 which is characterised by the use of digital technology in the learning process known as the cyber system and is able to make the learning process take place continuously without space and time limit. The challenges of education in the era of the industrial revolution 4.0, especially in Indonesia, are no longer just the classic problem of equality and access and educational infrastructure, but also about the quality of competent graduates able to meet demands of the development. Educators are required to be able to adapt to the times and be masters of technology so that they can instruct the students. At least students are already in the 3.0 era while their instructors are still around the 2.0, thus students have entered the digital 4.0 era while teachers are still struggling with the 3.0 era. Although the development of Education has not been able to optimally follow the speed of the industrial revolution, one of the challenges of the industrial revolution 4.0 is to improve the quality of teachers to be able to teach material in order to keep up with the times so as not to affect the quality of graduates.

An educator must be able to use information technology (IT) to improve the quality of teaching and learning process at every level of education (Christensen et al., 2011). This effort was made in order to be able to prepare superior human resources with global competence and be able to adapt to the existing era, even though information technology is developing so fast and learning resources are so easily obtained, the role of teachers as educators cannot be replaced by advances in technology when it is able to adapt.

The challenge of an educator does not stop with the ability to apply information technology in the teaching and learning process but there are 6 competencies that are expected to be held by teacher 4.0, namely:

1. Critical Thinking and Problem solving; the ability to understand a complex problem, connect information with other information, so that finally various perspectives emerge, and find solutions to a problem (Snyder & Snyder, 2008). This competence is interpreted as the ability to reason, understand and make complex choices; understanding the interconnection between systems, compiling, revealing, analysing, and solving problems. This is of paramount importance to the students in 21st century learning. Teachers of the 4.0 era must be able to mix learning so that they can export these competencies to students.
2. Communication and collaborative skills (Interprofessional Educational Collaborative et al., 2016). Information and communication technology-based skills that must be applied by teachers in learning to construct communication and collaboration competencies.

3. Creativity and innovative skills (creative thinking skills and innovation) (Hoegl & Parboteeah, 2007). The revolution wants students to always think creatively and innovatively, this needs to be able to compete and create jobs based on the industrial revolution 4.0. therefore, a teacher must first be creative and innovation in order to be able to pass on to students
4. Information and communication technology literacy (Information technology communication and communication) (ICT Literacy Panel, 2002). Information and communication technology (ICT) literacy is the teacher's obligation 4.0, this must be done so as to not to lag behind the students. Literacy Information and communication technology is the basis that must be mastered in order to be able to produce students who are ready to compete in the face of the industrial revolution 4.0.
5. Contextual learning skills (Borokhovski et al., 2016). This learning which is very suitable to be applied by teacher 4.0 when mastering ICT, contextual learning is easier to apply. At present ICT is one of the contextual concepts that must be known by the teacher, learning material.

Training is an activity to provide knowledge and skills to new or old workers (Andriani et al, 2018). The basic ability given to the workforce to increase workforce ability to mastering work fields to be owned (Dessler, 2013). Training is a systematic process for changing employee behaviour in the direction that will achieve organisational goals (Khasanah et al, 2019; Renata et al, 2018). Training is related to skills and abilities for the current job. It has a current orientation and helps employees master the special skills and abilities needed to be successful (Ivanceich, 2013) Training of planned efforts to facilitate the learning of knowledge, skills and behaviour related to work by employees (Noe, 2012). The conclusion is that training is an effort to improve abilities, skills, attitudes and behaviour of employees in carrying out their responsibilities as workers in accordance with their fields to be more effective and efficient. Modules are one of teaching material that is packaged in a whole and systematic way, which contains a set of planned learning experiences and it designed to help students master specific learning goals. Modules contain a minimum of learning objectives, learning material/substance and evaluation (Direktorat Pembina Sekolah Menengah Kejuruan, 2008). Modules as an independent learning package that includes a series of learning experiences that are planned and systematically designed to help students achieve learning goals (Mulyasa, 2015). Some characteristics of a module include, self-instruction and are self-contained, stand alone, adaptive, and user friendly (Direktorat Pembina Sekolah Menengah Kejuruan, 2008; Sarina et al, 2019).

E-Modules are also called media to be studied independently in software form or applications that are opened through electronic devices. Microtic is an operating system and software used

to be reliable network router computer. Microtic training the e-module that will be developed is a module that made in application form exe, which can be run with Adobe flash application help. The learning process is carried out independently in accordance with abilities of each individual (Sarina et al, 2019). The Microtic training module that is being used, expected to be a more effective and efficient learning tool or tools in utilising time and energy using computer and laptop technology. Combining text, images, audio and video in microtic training e-module, it is hoped that make training participants easier (Huda et al, 2020). The training module to be developed is an electronic module or e-module in application form so that it can be used on training participants' computers and laptops. The e-modules are designed used the Flipbooks application which is expected to make it easier to master the material, attract training participants to read and understand material and increase teacher's success in increasing competency skills. The research objectives are adjusted with problem formulation that is obtained, then following research objectives are carried out by developing microtic training e-modules for informatics teachers in computer network engineering. Developing valid and practical microtic training e-modules for informatics teachers in computer network engineering.

Research Methods

The research model used is Research and development (R&D). Development model is a set of procedures carried out sequentially in carrying out a product design and development (Sugiyono, 2013). The development method used is the development model proposed (Plomp, 2013) which consists of three steps, namely preliminary research, prototyping stage and assessment phase.

Table 2: Evaluation Criteria in Development Research (Ploomp and Nieveen, 2013)

Phase	Criteria	Description of Activities
Preliminary Research	Emphasis on content validity	Analysis of problems and literature studies. The result of this phase is the initial prototype design form
Development Phase	Focus on consistency (construct validity) and practicality	Development of prototypes which will be tested in stages and revised based on formative evaluation stage
Practicality Assessment	Practicality	Assess whether the user can use the product practically

Preliminary Research

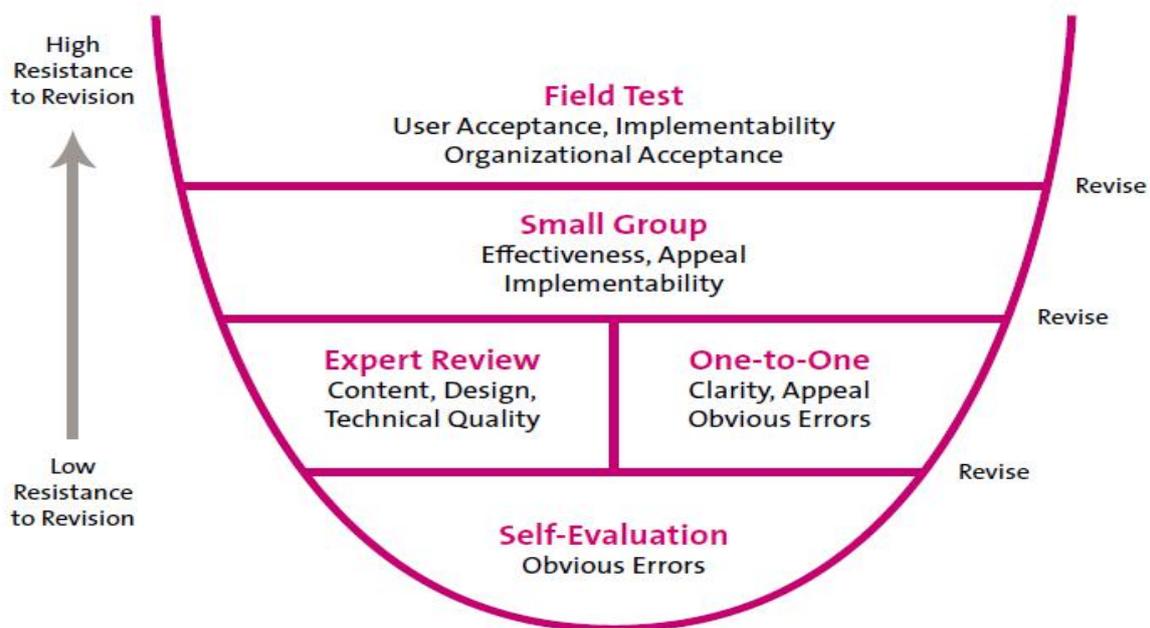
The preliminary research conducted is curriculum content structure analysis, concept analysis and teacher character analysis. In curriculum content structure analysis has be done microtic

material analysis based on curriculum references that apply in schools today. This analysis is intended to determine purpose of the subjects to be able to develop modules appropriately. Concept analysis is done by analysing existing material then researching and analysing it then choosing the right concept that will be developed in this research. Teacher analysis is carried out in order to find out character of the teacher so that development of e-modules is in accordance with the user's character and can function more effectively and efficiently for used.

Prototyping Stage

The results of microtic training e-module design are then evaluated and refined gradually based formative evaluation stage. Formative evaluation stages consist of self-evaluation, expert review, one-to-one evaluation, small group evaluation, and field test. as shown in Figure 1.

Figure 1. Steps on prototype stage (Ploomp and Nieveen, 2013)



Assessment Phase

The assessment stage is used to determine the practicality of the product to be developed. Practicality is the level of practicality and implementation of the product prototype by instructors and training participants, namely conducting training trials using a revised training e-module in accordance with results on prototype I and prototype II. The field testing of e-module microtic training for informatics engineering teachers in network computer

engineering competence was carried out for 30 Network Computer Engineering Teachers. The population of this study at State Vocational School in computer network engineering department, namely SMK 2 Padang has 3 TKJ teachers, SMK 3 Padang has 7 TKJ teachers, SMK 5 Padang has 4 TKJ teachers, SMKN 6 Padang has 8 TKJ teachers, and SMK 8 Padang has 10 TKJ teachers.

Table 3: Sample of TKJ Teacher Research in Padang City

No	Vocational school	TKJ Teacher total
1	SMK Negeri 2 Padang	3 people
2	SMK Negeri 3 Padang	7 people
3	SMK Negeri 5 Padang	4 people
4	SMK Negeri 6 Padang	8 people
5	SMK Negeri 8 Padang	10 people
Total		32 People

Validity analysis uses a Likert scale based on a validity questionnaire with steps: Each score uses a Likert scale is 1-5, summing scores of each validator for all validators, giving validity values by statistical aiken'n V

$$V = \sum s / [n (c - 1)]$$

With $s = r - I_0$; I_0 = lowest validity rating number; c = highest validity rating score; r = number given by assessor. Range Aiken'V calculation result between 0 to 1.00 and number 0.6 interpreted have high coefficient so the value of V 0.6 and above is stated valid category (Azwar, 2013).

Table 4: Response Criteria Categories

No	Achievement Level	Category
1	0,667 – 1,00	Valid
2	< 0,667	Invalid

Practicality analysis used Likert scale based on practicality questionnaire, with steps scoring each item with Likert scale 1-5, determining average score obtained by summing values obtained from many indicators, giving practical values with formula

$$NA = \frac{S}{SM} \times 100\%$$

With NA = final value; S = score obtained; SM = maximum score (Suharsimi, 2010).

Table 5: E-Module practicalities Categories (Riduwan, 2010)

No	Achievent Level	Category
1	81 – 100	Very Practical
2	61 – 80	Practical
3	41 – 60	Practical enough
4	21 – 40	Less Practical
5	0 – 20	Not Practical

Results and Discussion

The results of the study were obtained through several research steps, namely preliminary research prototyping stage, assessment phase.

Preliminary Research

Curriculum analysis refers to curriculum mastered by network computer engineering teachers, with material related to microtics, namely Basic Configuration, DHCP, Bridge, Routing, Wireless, Firewalls, QoS, Tunnels. Material analysis applying by reviewing books that discuss microtics. Then the researchers poured material points into Microtic Training E-Module. After conducting various analyses, the concepts adopted for packaging in E-Module of microtic training are basic level microtic material. In analysis of training participants carry out individual learning using e-module training, so that training participants can see and learn for themselves how e-module training can improve teacher understanding about microtic.

Prototyping Stage (Prototype Development)

In prototype development step has a purpose to test the modules developed: In this Prototype I module that has been developed is seen and revised by researcher.

Figure 2. E-Module Microtic Training Cover Display



The cover is an outside page from module that created using Photoshop software. By displaying the router board, virtualbox, winbox and symbols from microtic which are part from microtic.

Figure 3. The Main Menu Microtic Training E-Module Display



The main page displays module cover that inserted into flipbooks application, with additional background display, several navigation icons to guide module usage.

Figure 4. Module Usage Page Display

	Full screen	Untuk membesarkan dan mengecilkan tampilan layar		Table of contents	Untuk menampilkan konten modul
	Search	Untuk mencari isi dokumen		Bookmarks	Untuk membuka bookmark
	Zoom Out	Untuk mengecilkan ukuran tampilan modul		First Page	Untuk menuju kehalaman awal
	Zoom In	Untuk membesarkan ukuran tampilan modul		Last Page	Untuk menuju kehalaman sebelumnya
	Thumbnails	Untuk melihat secara keseluruhan isi modul		Play	Untuk memulai modul secara otomatis
	Print	Untuk mencetak modul		Previous Page	Untuk menuju kehalaman selanjutnya
	Share	Untuk membagikan modul		Next Page	Untuk menuju kehalaman akhir
	Music	Untuk menghidupkan dan mematikan suara atau musik	<input type="text"/>	Page	Untuk mencari halaman modul
	Download	Untuk mendownload modul	<input type="text"/>	Pencarian	Untuk mencari teks

The module usage guide displays the functions of module usage navigation icon, starting from setting screen size, running the application, searching for page or text that they want, sound settings and download.

Figure 5. Study Page Display

3. Via Winbox

Winbox merupakan tool untuk remote Mikrotik yang paling populer karena selain mudah juga dapat menampilkan menu-menu pada Mikrotik secara GUI. Tampilan awal konfigurasi winbox seperti ini :

Gambar 1.6 Winbox

Winbox bisa mendeteksi Mikrotik yang sudah di install awal masih dalam satu network, yaitu dengan mendeteksi MAC address dari ethernet yang terpasang di Mikrotik. Untuk bisa mengakses Mikrotik menggunakan winbox bisa dengan menggunakan IP Address Mikrotik maupun MAC Address Nya

4. Via Telnet

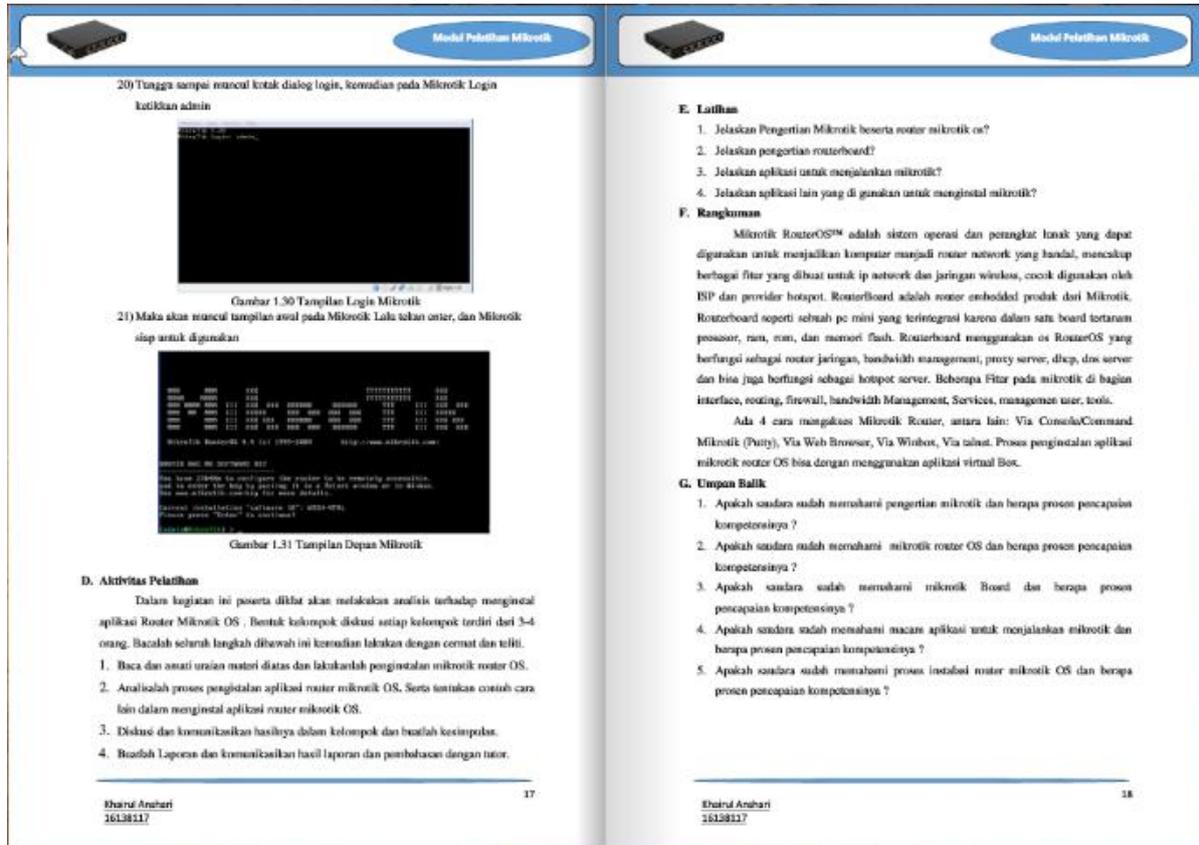
Kita dapat me-remote Mikrotik menggunakan telnet melalui program aplikasi "command prompt" (cmd) yang ada pada windows yang fitur Telnet sga sudah diaktifkan. Namun, penggunaan telnet tidak dianjurkan dalam jaringan karena masalah keamanannya.

Contoh :

Gambar 1.9 Tampilan Mikrotik Pada Telnet

The study page displays the contents of microtic module material, from introduction to material from beginning to ending of learning activities.

Figure 6. Exercise Page Display



The exercise page displays some questions discussed to find out how far participants' understanding about material in each learning activity.

Figure 7. Key Answers Page Display



Modul Pelatihan Mikrotik

H. Kunci Jawaban

1. Mikrotik adalah nama perusahaan pemegang lisensi Mikrotik yang berlokasi di Riga, Ibukota Latvia, sebuah negara pecahan Uni Soviet yang bersebelahan dengan Rusia. Mikrotik merupakan produsen software dan hardware router Mikrotik
2. Mikrotik RouterOS™ adalah sistem operasi dan perangkat lunak yang dapat digunakan untuk menjadikan komputer menjadi router network yang handal, mencakup berbagai fitur yang dibuat untuk ip network dan jaringan wireless, cocok digunakan oleh ISP dan provider hotspot
3. RouterBoard adalah router embedded produk dari Mikrotik. Routerboard seperti sebuah pc mini yang terintegrasi karena dalam satu board tertanam prosesor, ram, rom, dan memori flash. Routerboard menggunakan os RouterOS yang berfungsi sebagai router jaringan, bandwidth management, proxy server, dhcp, dan server dan bisa juga berfungsi sebagai hotspot server
4. Ada 4 cara mengaktifkan Mikrotik Router , Via Console/Command Mikrotik, Via Web Browser, Via Winbox, Via telnet
5. Instalasi RouterOS Mikrotik menggunakan VirtualBox, membuat bootdisk baru untuk memberi memori yang dibutuhkan oleh mikrotik routerOS, menginstall routerOS ke dalam hardisk, lalu menjalankan aplikasi untuk menginstall mikrotik dengan memilih bagian sistem yang akan di install, tunggu hingga proses penginstalan selesai dan masuk sebagai admin dengan mengkonfigurasi password.

19

Ehrafat Anshari
16138117



Modul Pelatihan Mikrotik

KEGIATAN BELAJAR 2

A. Tujuan Pelatihan

1. Peserta menganalisis standar komunikasi data
2. Peserta Menganalisis proses komunikasi data
3. Peserta Menganalisis komunikasi dalam jaringan mikrotik

B. Indikator Pencapaian Kompetensi

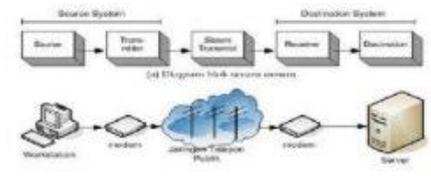
1. Menganalisis standar komunikasi data
2. Menganalisis proses komunikasi data
3. Menganalisis komunikasi dalam jaringan mikrotik

C. Uraian Materi

Komunikasi data adalah hubungan atau interaksi (pengiriman dan penerimaan) antar device yang terhubung dalam sebuah jaringan, baik yang dengan jangkauan sempit maupun dengan jangkauan yang lebih luas.

Kegunaan dasar dari sistem komunikasi ini adalah menjelaskan pertukaran data antara kedua belah pihak gambar dibawah ini ditampilkan satu contoh komunikasi antara workstation dan server yang dihubungkan dengan suatu jaringan telepon umum. Contoh lainnya adalah pertukaran sinyal-sinyal suara antara dua telepon pada satu jaringan yang sama.

Berikut ini elemen-elemen model komunikasi data tersebut.



20

Ehrafat Anshari
16138117

This page displays answers for discussion questions contained in this module, the purpose of answer key is to find out about answers to the discussion. E-module validation assessment data results by media experts in Table 6.

Table 6: Validation Results for E-Training Modules

No	Validation Aspect	V1	V2	V3	Category
1	Didactic Requirements	0,92	0,87	0,89	Valid
2	Construction Requirements				
3	Technical Requirements				

The analysis results of module validation sheet with 3 aspects namely didactic aspects, construction aspects and technical aspects by 3 module validator experts obtained results from validator 1 with an average 0.92 with valid category, from validator 2 with average 0.87 with valid category, and from validator 3 with average 0.89 with valid category, based on the results of 3 validator, averaged values with valid category. The results of material validation shown in Table 7.

Table 7: Material Validation Data on E-training modules

No	Validation Aspect	V1	V2	V3	Category
1	Content Quality	0,84	0,83	0,82	Valid
2	Learning Quality				
3	Quality of Interaction				
4	Display Quality				

Based on the module validation, it can be concluded that the module is valid. In material validation with 4 aspects obtained content quality, learning quality, interaction quality, and display quality, based on 3 material experts obtained from validator 1 with average 0.84 with valid category, validator 2 with average 0, 83 with valid category, and validator 3 with average 0.82 with a valid category based on the results of material validation, the conclusion is that module material is valid.

Stage Assessment

Assessment Stage is used to determine practicality of the modules that have been developed. Practicality questionnaire results for practicality questionnaire responses given to training participants.

Table 8: Practicality Data

No	Aspects	Instructor	Training Participant
1	Easiness	86,67 %	84,75 %
2	Time	86 %	77,33 %
3	Usability	85 %	78,86 %
Average total		85,89 %	80,31 %
Category		Very Practical	Very Practical

The results of practicality e-module research were based on training participants' responses toward time, and e-modules usage includes practical categories. The practicality was based on the analysis results from instructor response questionnaire on 3 aspects: the convenience aspect obtained results is 86.67%, the practical aspect as in time effectiveness obtained results is 86%, and the utilisation aspect obtained results is 85% within the practical category, Based on these calculations the results obtained an average value of 85.89%. It can be concluded that the training module according to the instructor is practical. Training participants' responses from convenience aspect obtained results is 84.75% within the practical category. The time effectiveness aspect obtained results is 77.33% within the practical category, and utilisation obtained results is 78.86% within the practical category. Based on these calculations the results obtained the average value of 80.31% and it can be concluded that the training module is practical. The final result of this study is a microtic



training e-module used by teachers to improve the competency skills of the teachers in computer network engineering field of microtic.

Conclusions

This research is research development that produces microtic training e-modules. Based on the processes and results of the study, it was concluded that e-module training of informatics engineering teachers in computer network engineering field – with flipbooks application and development model of Ploomp and Nieveen – consisted of the preliminary research stage, the development stage and the assessment stage. Valid and practical e-module training for informatics engineering teachers in computer network engineering field has been developed. Based on the conclusions and findings, the implication of this study is that e-module of microtic training can be used as source in microtic learning on basic fields and provides convenience in training, so as to offer an affective training process that improves the training result of participants. The teacher needs to utilise this module wherever and whenever possible. Teachers who cannot utilise microtic must gain additional knowledge about microtics use, as well as how to set up microtic installation and security. Teachers can get ideas for developing learning aids by using flipbooks application for learning activities about computer and network engineering. Based on results of the study, the researchers suggested that the developed microtic training module is referenced for use by training participants in each school. It is hoped that this e-module training can be tested further at other schools to see wider practicality and effectiveness. Further researchers are advised to provide innovation in developing microtic training e-modules.

Limitation and Further Research

There are some limitations of the study that offer room for improvement in a future study. Among three important actors in this research, government and Education representatives were interviewed about their role in determining E-Module Microtic Training toward Computer Network Engineering Teachers, school quality, and improve quality education. A Future Study could add the society 5.0 implementation E-module form the ministry of research, technology and vocational education along with other supporting actors from the government, venture capital, sustained Development Goals (SDGs). Regarding the findings the authors suggest creating assessment practice. There are many opportunities to take this study future.



REFERENCES

- Andriani, S., Kesumawati, N., & Kristiawan, M. (2018). The Influence of the Transformational Leadership and Work Motivation on Teachers Performance. *International Journal of Scientific & Technology Research*, 7(7).
- Azwar, S. (2013). *Metode Penelitian [Research Method]*. Yogyakarta: Pustaka Pelajar
- Borokhovski, E., Bernard, R. M., Tamim, R. M., Schmid, R. F., & Sokolovskaya, A. (2016). Technology-supported student interaction in post-secondary education: A meta-analysis of designed versus contextual treatments. *Computers and Education*. <https://doi.org/10.1016/j.compedu.2015.11.004>
- Chinoracký, R., & Čorejová, T. (2019). Impact of digital technologies on labor market and the transport sector. *Transportation Research Procedia*. <https://doi.org/10.1016/j.trpro.2019.07.139>
- Christensen, C., Horn, M. B., Caldera, L., & Soares, L. (2011). Disrupting College. *Center for American Progress*. <https://doi.org/10.1306/74D70D8F-2B21-11D7-8648000102C1865D>
- Dessler, G. (2013). *Human Resource Management*. (Fifteenth Edition). Florida International University: Pearson
- Direktorat Pembina Sekolah Menengah Kejuruan. (2008). *Petunjuk Teknis Pelaksanaan Kurikulum Tingkat Satuan Pendidikan [Technical Guidelines for Implementing Education Unit Level Curricula]*. Jakarta Direktorat Pembina Sekolah Menengah Kejuruan
- Fitria, H., Kristiawan, M., & Rasyid, A. (2019). The Educational Character on Instruction. *Opción*, Año 35, Especial No.21 (2019): 964-979
- Griffiths, F., & Ooi, M. (2018). The fourth industrial revolution - Industry 4.0 and IoT [Trends in Future I and M]. *IEEE Instrumentation and Measurement Magazine*. <https://doi.org/10.1109/MIM.2018.8573590>
- Hoegl, M., & Parboteeah, K. P. (2007). Creativity in innovative projects: How teamwork matters. *Journal of Engineering and Technology Management - JET-M*. <https://doi.org/10.1016/j.jengtecman.2007.01.008>
- Huda, A., Azhar, N., Almasri, Anshari, K., & Hartanto, S. (2020). Practicality and effectiveness test of graphic design learning media based on android. *International Journal of Interactive Mobile Technologies*, 14(4), 192–203. <http://doi.org/10.3991/IJIM.V14I04.12737>



- Huda, A., Azhar, N., Almasri, & Fadli, R. (2019). Design of learning media graphic design through android technology-based. *International Journal of Recent Technology and Engineering*, 8(2 Special Issue), 254–258.
- ICT Literacy Panel. (2002). Digital Transformation: A Framework for ICT Literacy. A Report of the International ICT Literacy Panel. *Educational Testing*.
- Interprofessional Educational Collaborative, Practice, I. C., & Values, U. (2016). Core Competencies for Interprofessional Collaborative Practice: 2016 Update. *Interprofessional Education Collaborative*.
<https://doi.org/10.1097/ACM.0b013e3182308e39>
- Ivanceich M. John. (2013). *Human Resource Management*. Twelfth Edition. :McGrawHill
- Khasanah, U., Kristiawan, M., & Tobari. (2019). The Implementation of Principals' Academic Supervision In Improving Teachers' Professionalism in the State Primary Schools. *International Journal of Scientific & Technology Research*, 8(8).
- Lase, D. (2019). Education and Industrial Revolution 4.0. *Handayani Journal PGSD FIP Unimed*. <https://doi.org/10.24114/jh.v10i1.14138>
- Mulyasa, E. (2015). *Kurikulum Berbasis Kompetensi, Konsep Karakteristik Implementasi Dan Inovasi [Competency Based Curriculum, Concept Characteristics of Implementation and Innovation]*. Bandung: PT. Remaja Rosdakarya
- Noe R. A. (2012). *Human Resource Management: Gaining A Competitive Advantage*. McGrawHill
- Ploomp, T & Nieveen N. (2013). *An Introduction to Educational Design Reseach*. Neteherland. Enschede
- Renata, R., Wardiah, D., & Kristiawan, M. (2018). The Influence of Headmaster's Supervision and Achievement Motivation on Effective Teachers. *International Journal of Scientific & Technology Research*, 7(4).
- Riduwan. (2010). *Belajar Mudah Penelitian Untuk Guru-Karyawan Dan Peneliti Pemula [Easy Learning Research For Teacher-Employees And Beginner Researchers]*. Bandung. CV. Alfabeta
- Sarina., Kristiawan, M., & Wardiah, D. (2019). Module Development the Utilisation of Patchwork Fabric As Teaching Materials Crafts on the Subjects of Craft and Entrepreneurship For High School Students. *International Journal of Scientific & Technology Research*, 8(5).



- Suharsimi A. (2010). *Dasar-Dasar Evaluasi Pendidikan [Basics of Educational Assessment]*. Jakarta. Rineka Cipta
- Sugiyono. (2013). *Metode Penelitian Kuantitatif, Kualitatif dan R&D [Quantitative, Qualitative, and R&D Research Methods]*. Bandung. Alfabeta
- Snyder, L. G., & Snyder, M. J. (2008). Teaching critical thinking and problem solving skills. *The Delta Pi Epsilon Journal*.
- Tobari., Kristiawan, M., & Asvio, N. (2018). The Strategy of Headmaster on Upgrading Educational Quality In Asean Economic Community (AEC) Era. *International Journal of Scientific & Technology Research*, 7(4).