The Development of Professional Competency Certification Assessment Model for Junior Mobile Programmers

https://doi.org/10.3991/ijim.v17i08.39213

Dony Novaliendry[1,2(✉)], Ahyanuardi[1], Irma Yulia Basri[1], Noper Ardi[3], Nathasyah Utami Hakim[1], Muhammad Fadilh Putra Pratama[1], Nenny Mahyudin[4]
[1] Universitas Negeri Padang, Padang, Indonesia
[2] National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan
[3] Politeknik Negeri Batam, Batam, Indonesia
[4] Department of Early Childhood Education, Universitas Negeri Padang, Padang, Indonesia
dony.novaliendry@ft.unp.ac.id

Abstract—Indonesia's Vision 2045 is an essential basis to determine the direction of the country's development in line with four main pillars which include the development of human resources (HR). This involves producing quality, healthy, intelligent, adaptive, innovative, and skilled human resources with character. The achievement of this goal requires the improvement of the competence and professional certification quality towards ensuring HR are reliable and competent in different fields such as the vocational area which involves Informatics Engineering (IT). Therefore, this research was conducted based on the gap observed in HR which is indicated by a lower proportion of Indonesian workers in the IT field compared to other ASEAN countries. It was also observed that the assessment process and results of the Junior Mobile programmer scheme by the Professional Certification Institute (LSP) for Digital Technology have not been optimally tested. This is indicated by the fact that the assessment activities are being conducted without the full implementation of a centralized and systematic technology-based system, thereby causing problems in the remote assessment process. Moreover, professional associations, academia, and industry were not involved in designing a tested and reliable assessment model. I this research was conducted from March 2022 to December 2023 with the trial subjects from the Digital Talent Scholarship (DTS) training program, Vocational School Graduate Academy (VSGA) of the Ministry of Communications and Informatics. There were 40 sessions which consist of 20 for the experimental class and 20 for the control class. Furthermore, the data collection instruments included questionnaires, documentation, interview guides, observations, and competency tests while descriptive and quantitative analyses were conducted through the I'ken V and factor analysis tests using the LISREL and SPSS applications.

Keywords—assessment, competency certification, Junior programmer

1 Introduction

The Indonesian government is trying to build superior, cultured, and expert citizens in science and technology. This is in line with the country's Vision 2045 and the 2020-2024 RPJMN which is focused on having quality human resources (HR), snowballing economy, as well as a clean, solid, and democratic country. However, according to the BPS, the proportion of education graduates in Indonesia is lower at approximately 40.60% compared to other ASEAN countries. It was also discovered that the government and the poor lack the ability to explore technology (Mwangi, 2020).

Digital transformation was observed to have influenced economic development in Indonesia, thereby leading to an increase in the need for Informatics Engineering (IT) experts in the programming field (Sikandar et al., 2022). It was observed that the number of skilled and reliable HR programmers is minimal and unable to meet the demands of the digital industry. This creates a considerable gap as indicated by the programmer power crisis and the importation of experts from abroad (Setiawan, 2019).

The production of reliable HR requires conducting competency certification tests based on the Indonesian national work competency standards. According to (Setiawan, Widiyanti & Sunomo, 2018), the certification by the Professional Certification Institute (LSP) is usually preceded by an assessment process to ensure the competence of the individual satisfies the requirements and standards set with a focus on the cognitive, skills, and affective aspects (Andiani, Hajizah, & Dahlan, 2020; Nento, 2018; Setiawan, Widiyanti & Sunomo, 2018).

A problem observed during the assessment of the Junior Mobile programmer scheme run by LSP Digital Technology is the lack of involvement of Professional, Academic, and Industrial Associations in the process of designing the model. Moreover, there is no full optimization of online, remote, and digitalization systems in the assessment process. It was also reported that the model being applied has not been tested and this means there is no guarantee of certification for alumni to become employable or digital entrepreneurs (Agustien, Umamah, & Sumarno, 2018; Candra et al., 2022; Huda et al., 2021). These problems indicate the need to develop an assessment model for IT competency certification for vocational school graduates (Iswahyudi et al., 2019; Cherednichenko, 2020; Ardi & Isnayanti, 2020).

There is a need to develop an IT competency assessment model to certify vocational alumni through the Ministry of Communications and Information Technology's Vocational School Graduate Academy (VSGA) program to ensure they become Digital Talent Preneurs (Digital Talent Entrepreneurs). This is important to ascertain the implementation of a digital-based assessment system involving professional associations, academics, and industry which is required to form professional behavior among reliable, ready-to-work, and ready-to-be-entrepreneur Junior Mobile Programmers. It is important to note that the specifications of the product to be developed include model books, web-based e-assessment systems and their applications, modules, and manuals (Ardi, 2021)(Van et al., 2022)(Vaicondam et al., 2022). Therefore, this research focuses on developing a professional competency certification assessment model for Junior Mobile Programmers to improve the relevance and quality of their professional competence and certification.

2 Materials & method

2.1 Assessment

According to (Zainal, Priyatni, & Widiati, 2018; Muri, 2015; Nurhikmah & Kadarwati, 2021), assessment is a series of processes conducted to obtain information needed to design policies and make decisions within the scope of programs, measuring instruments, institutions, and others such as the position and means of measuring success in learning. Meanwhile, the self-assessment model is proposed to measure competence (Levett-Jones et al., 2011; LeMone & Burke, 2008; Khampirat & Bandaranaike, 2019).

2.2 Competency

Competence is defined as the ability to do a job due to the possession of certain skills, cognition, and attitudes (Devi & Suartana, 2014). Previous research (Ducrot & Shankararaman, 2015; Shankararaman & Ducrot, 2016) divided the learning life cycle and competency framework into 5 phases which include content design, assessment design, content delivery and assessment, assessment feedback, and content review. Moreover, Iceberg (Yuan et al., 2013) also developed a competency model to train staff as indicated in the Figure 1.

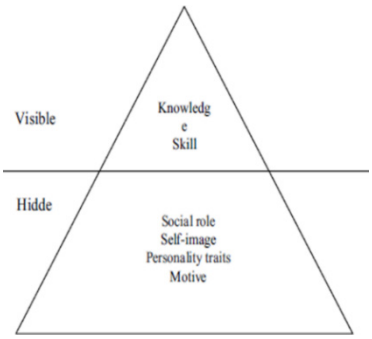

Fig. 1. Iceberg Model

Another competency development model by (Triyono et al., 2019) is as follows.

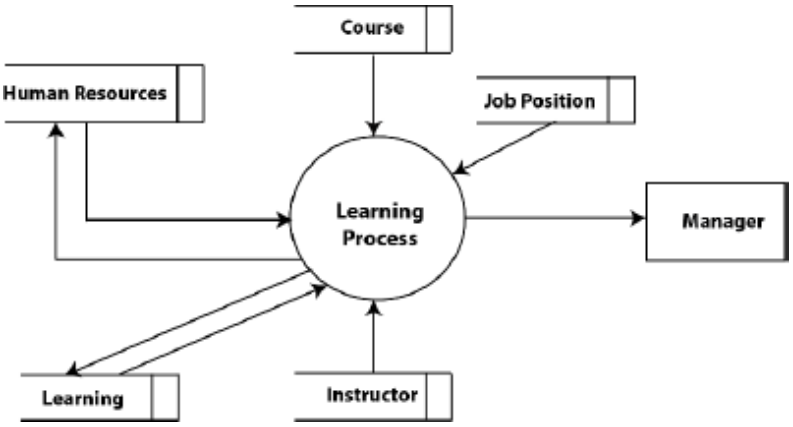

Fig. 2. IT-Based Competency System Development Model

A person's competence needs to be constantly developed in line with the present and future standards (Irmawati, 2017). This is the reason the professional certification process at LSP is required in HR development. The institution, however, needs to obtain the National Professional Certification Agency (BNSP) to maintain credibility and consistency.

Junior Mobile Programmer is a certification scheme which is based on the Indonesian National Work Competency Standards. It is focused on developing the skills to create and develop mobile-based software with the Android operating system as currently required in the industry. An individual with this certification is required to engage in junior or primary level mobile Programming such as writing and creating software and operating systems.

2.3 Competency and professional certification

A profession is defined as a field of work with functions and duties requiring a person to fulfill some competencies related to the domain (Lau et al., 2011) such as the development of interest-based competencies toward careers in information technology. Moreover, (Alkiş & Ozkan, 2010) applied the Technology Accepted Model (TAM) to design e-assessment using a web-based assessment feature as indicated in the Figure 3.

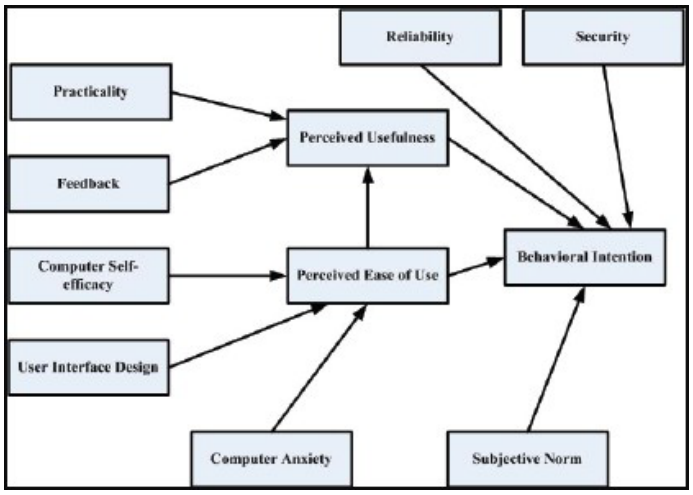

Fig. 3. Development of the TAM Model in the Implementation of e-assessment

The institution with the authority to issue competency certification is BNSP and this means it needs to adopt an international examination system such as Cisco (Dedrick et al., 2019). This is to ensure the competency test venues and the participants work in line with the assessment principles set by BNSP.

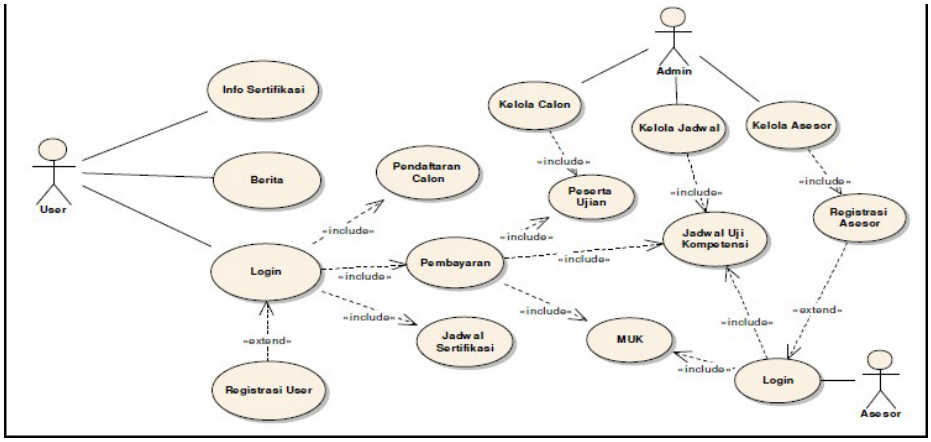

Fig. 4. Model Driven UWE Professional Certification

2.4 Conceptual foundation

The basic foundation to develop a professional competency certification assessment model for Junior Mobile Programmers is to improve the quantity and quality of DTS program graduates from the scheme. It was observed that the assessment model currently being applied is not in line with the certification test conducted by the Digital

Technology LSP because it is conventional and does not involve several parties in the assessment process.

The variables used in developing the model were adopted from several relevant previous research which have been updated to include a more authentic experience of industry needs, assessment of the junior professional competency certification for Mobile Programmers, digital technology, online activities, and IDIC. This is necessary to achieve the quality assessment, accreditation, and improvement of professional competence.

2.5 State-of-the-art research

Researcher (Year)	Research Title	Research Conducted
(Handayani & Harsono, 2016)	Regarding the Technology Acceptance Model (TAM) Application	Technology Accepted Model
(Devi & Suartana, 2014)	TAM Analysis	Technology Accepted Model
(Sukardi & Soenarto, 2015)	Industry Needs-Based Assessment	Model Assessment AILIS
(Dedrick et al., 2019)	Engineering Certificate in Medicine	IT Certification
(Erawan et al., 2015)	Competency Certification Web Information System Model Engineering	Professional Certification
(Vinanda et al., 2019)	Development of an Assessment Information System for Professional Certification Institutions	Professional Assessment
(Irmawati, 2017)	Automation of Assessment Documents at Professional Certification Agencies.	Professional Certification
(Erawan et al., 2017)	Information System for Competency Certification Services at LSP MIKA Based on IT and Web	Service Information System
(Wa et al, 2017)	Designing a Web-Based Information System to Provide Monitoring Features for PLN Employee Certification	Service Information System
(Sukma et al., 2019)	Effect of TAM and Trust on Social Media User Intentions	Technology Accepted Model
(Sayekti & Putarta, 2016)	The Application of the TAM Model in Testing Regional Financial Information Systems	Technology Accepted Model

2.6 Method

The Borg and Gall method was adopted for Research and Development through the following stages:

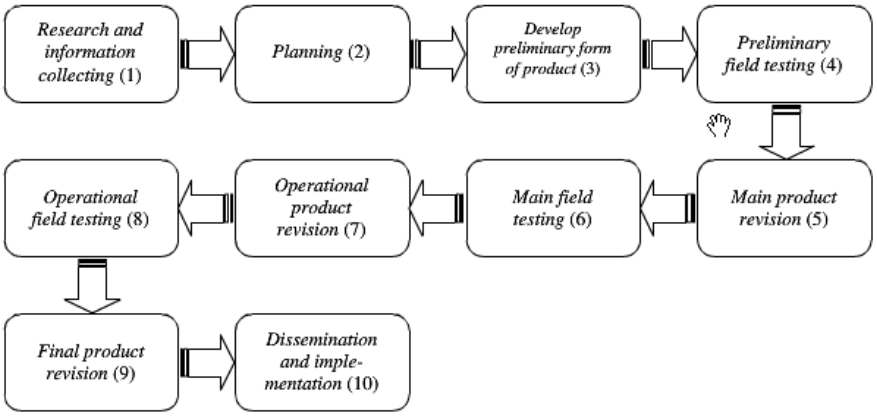

Fig. 5. Design of the Educational Research & Development (R & D)

The 10 steps involved in this method were simplified into 4 which include 1) data collection, 2) product planning and design, 3) development, and 4) validation and trial phase.

FGDs were conducted with experts in vocational education, evaluation and assessment, linguistics, IT, and competency certification. The experimental subjects were 40 participants from the VSGA Kemkominfo program training of DTS with 20 used for the practical class and 20 for the control class. The research instrument used to obtain data on competency certification includes observation and interview guides after which documentation was made on the background, circumstances, report on the results of competency certification, and other information from LSP. Moreover, the competency of the participants was determined through written, practical and oral examinations. The data obtained were analyzed using inferential and descriptive analysis. This involved the application of the I'ken V test to determine the validity and practicality, SEM LISREL to evaluate the effectiveness of the model, and SPSS for the competency test.

The indicators of success were achieved by focusing on research problems and objectives as well as relevant research. The variables tested in designing the preliminary model include the level of professional competency certification assessment model for Junior Mobile Programmers, web-based e-assessment applications, and other supporting products such as model books, manuals, as well as implementation success and its subsequent impact.

3 Results and discussion

3.1 Results

The effectiveness of the professional competency certification model developed for the Junior Mobile Programmer scheme was tested by comparing the pretest and posttest

scores of 30 research respondents, and the processes involved are explained in the following sub-section.

Written test. The written test was used to determine and measure the intellectual capacity or thinking function of the respondents and the results obtained after data processing are stated in Table 1:

Table 1. Pre-Test and Post-Test Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pre_Eks	30	50	77	66,47	6,942
Pos_Eks	30	80	100	87,83	5,820
Pre_Kon	30	50	80	66,97	7,559
Pos_Kon	30	60	90	76,93	6,938
Valid N (listwise)	30				

Table 1 shows that the average ability score of the respondents for the pretest was 66.47 and this increased to 87.83 after the learning has been provided. Meanwhile, the detailed distribution of the pretest data based on the experimental interval classes is further stated in Table 2:

Table 2. Experimental Class Pretest Results

Pre_Eks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	50	1	3,3	3,3	3,3
	60	10	33,3	33,3	36,7
	65	6	20,0	20,0	56,7
	70	4	13,3	13,3	70,0
	74	3	10,0	10,0	80,0
	75	5	16,7	16,7	96,7
	77	1	3,3	3,3	100,0
	Total	30	100,0	100,0	

The frequency distribution of the posttest in the experimental class is also presented in Table 3.

Table 3. Experimental Class Posttest Results

Pos_Eks					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	80	4	13,3	13,3	13,3
	81	2	6,7	6,7	20,0
	83	1	3,3	3,3	23,3
	84	2	6,7	6,7	30,0
	85	5	16,7	16,7	46,7
	87	1	3,3	3,3	50,0
	89	2	6,7	6,7	56,7
	90	6	20,0	20,0	76,7
	92	1	3,3	3,3	80,0
	95	4	13,3	13,3	93,3
	100	2	6,7	6,7	100,0
	Total	30	100,0	100,0	

The table shows that the average ability of the respondents during the pretest was 66.97 and the training provided increased the ability to 76.93. Meanwhile, more detailed distribution of the pretest data for the control interval classes is indicated in the following tables.

Table 4. Pretest Test Results for Control Class

Pre_Kon					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	50	1	3,3	3,3	3,3
	55	1	3,3	3,3	6,7
	56	1	3,3	3,3	10,0
	59	2	6,7	6,7	16,7
	60	4	13,3	13,3	30,0
	63	1	3,3	3,3	33,3
	64	1	3,3	3,3	36,7
	65	3	10,0	10,0	46,7
	68	1	3,3	3,3	50,0
	70	5	16,7	16,7	66,7
	71	1	3,3	3,3	70,0
	73	1	3,3	3,3	73,3
	74	2	6,7	6,7	80,0
	75	4	13,3	13,3	93,3
	78	1	3,3	3,3	96,7
	80	1	3,3	3,3	100,0
	Total	30	100,0	100,0	

Table 5. Posttest Test Results for Control Class.

Pos_Eks					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	80	4	13,3	13,3	13,3
	81	2	6,7	6,7	20,0
	83	1	3,3	3,3	23,3
	84	2	6,7	6,7	30,0
	85	5	16,7	16,7	46,7
	87	1	3,3	3,3	50,0
	89	2	6,7	6,7	56,7
	90	6	20,0	20,0	76,7
	92	1	3,3	3,3	80,0
	95	4	13,3	13,3	93,3
	100	2	6,7	6,7	100,0
	Total	30	100,0	100,0	

3.2 Prerequisite test

Homogeneity test statistics were conducted to determine the homogeneous data while the Kolmogorov-Smirnov test was applied to assess the normality. Moreover, paired sample t-test was used to determine the possible changes between the experimental and the control classes using the SPSS version 25 program.

Homogeneity test. The homogeneity of the data used for analysis in the two groups was determined using the Levene Statistical Test and the results are presented in Table 6.

Table 6. Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Hasil Belajar Siswa	Based on Mean	,731	3	116	,536
	Based on Median	,858	3	116	,465
	Based on Median and with adjusted df	,858	3	115,200	,465
	Based on trimmed mean	,771	3	116	,513

Table 6 shows that the sig value obtained from the test was 0.536 and this is more than 0.05, indicating the data used are homogeneous because the value has a considerable probability of sig > 0.05.

Normality test. A normality test was conducted to determine whether the research data were normally distributed. This is necessary because standard data is an absolute

requirement to perform parametric statistical analyses such as paired samples and independent t-tests. In parametric statistics, two kinds of normality tests are often used and these include the Kolmogorov and the Shapiro-Wilk tests and they were both applied as indicated in Table 7.

Table 7. Normality Test

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil Belajar Siswa	Pre Test Eksperimen	,159	30	,052	,937	30	,076
	Post Test Eksperimen	,204	30	,003	,933	30	,060
	Pre Test Kontrol	,156	30	,061	,961	30	,330
	Pos Test Kontrol	,137	30	,154	,964	30	,397

a. Lilliefors Significance Correction

Table 7 shows that the pretest value for the experimental and control classes was 0.076 and 0.330, respectively, which are more than 0.05, indicating the data are normally distributed. A similar trend was reported for the post-test with 0.060 and 0.397, respectively, which are also more than 0.05, showig normal distribution. This shows that the significance value (sig.) for all data in both the Kolmogorov-Smirnov and the Shapiro-Wilk tests are > 0.05. It was concluded that the research data are normally distributed and parametric statistics such as paired sample t-tests can be applied for analysis to determine the difference in learning outcomes between the students taught using information systems media and those prepared using conventional media, specifically web programming schemes.

3.3 Independent sample t-test

An independent sample t-test was conducted to determine the difference in learning outcomes between respondents taught using the professional competency certification model developed for the Junior Mobile Programmer scheme and those who did not take the certification. The hypotheses formulated are stated as follows:

H0: There is no difference between the learning outcomes of participants taught using the competency test and certification training model and those who used conventional media.

Ha: There are differences in the learning outcomes of participants taught using the competency test and certification training model and those who used conventional media.

The results for the experimental and control classes are presented in the Table 8.

Table 8. Test Results of independent sample t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Low	Up
Nilai_ Test	Equal variances assumed	,188	.666	2.424	58	.019	4,233	1,474	,737	7,730
	Equal variances not assumed			2.264	57,844	.019	4,233	1,474	,737	7,730

Table 8 shows that the F-count Levene test was 0.188 with a probability of 0.666 > 0.05 and this means the variance is the same. The t-count value at this equal variance was recorded to be 2.424 with a significant chance of 0.019 (two-tailed) while the t-table was 1.697. This means t-count > t-table or 2.424 > 1.697, hence, Ha is accepted and Ho is rejected. It was concluded that there are differences in the learning outcomes of participants taught using the competency test and certification training model compared to those trained using conventional media. Moreover, the summary of the inferential statistics results is presented in Table 9.

Table 9. Summary of Inferential Statistical Results

Group	Normality Test	Homogeneity test	*T-Test*
Experiment	Normal	Homogen	H_0 Rejected
Control	Normal		

Table 9 shows that the data used for both the experimental and control groups are homogeneously and normally distributed. The subsequent independent sample t-test conducted further indicated differences in the learning outcomes of participants taught using the model developed and those trained using conventional media. The detailed results of these analyses are presented in the appendix.

3.4 Observation test

The Junior Mobile Programmer scheme was practically observed and assessed based on certain indicators such as work preparation, processes, results, attitudes, and time, and the results are presented in the following table.

Table 10 shows that the experimental class which applied the model developed has higher average values compared to the control class.

Table 10. Assessment of Learning Outcomes through Practical Tests

Indicator	Experiment class	Control class
Work preparation	84,44	72,00
Work process	90,00	70,96
Work result	89,90	70,49
Work attitude	91,33	77,00
Time	88,67	74,44

4 Conclusion

This research develops a valid, practical, and effective Junior Mobile Programmer professional competency certification assessment model. The purpose is to provide practical benefits in the field of education, specifically technology and vocational education, through the increment in the relevance and quality of competence and professional certification. The research and development process involved the application of the Borg and Gall method which was modified to include data collection stages starting from 1) the Preliminary Research and Needs Analysis; 2) Planning and Product Design including model design, web-based e-assessment system and its application, model books, modules, and guidebooks; 3) Development conducted by making applications, model books, other products, and FGDs; and 4) Validation and Trial involving validation, practical tests, model implementation, and effectiveness assessment.

The findings showed differences in the learning outcomes of participants taught using the model developed and those trained using conventional media. This was indicated by the t-count value at equal variance which was recorded to be 2.424 with a significant probability of 0.019 (two-tailed) while the t-table was 1.697. This indicates t-count > t table or 2.424 > 1.697, thereby leading to the acceptance of the Ha and rejection of the Ho.

5 Acknowledgment

The authors are grateful to all parties involved in the success of this research including the research team, lecturers, students, survey officers, research assistants, and respondents.

6 References

[1] Agustien, R., Umamah, N., & Sumarno, S. (2018). Pengembangan media pembelajaran video animasi dua dimensi situs Pekauman di Bondowoso dengan model ADDIE mata pelajaran Sejarah kelas X IPS. *Jurnal Edukasi*, *5*(1), 19–23. https://doi.org/10.19184/jukasi.v5i1.8010

[2] Alkiş, N., & Ozkan, S. (2010). Work in progress—A modıfied technology acceptance model for e-assessment: Intentıons of engıneerıng students to use web-based assesment tools. *40th ASEE/IEEE Frontiers in Education Conferenc*, *December*, S1G-1-S1G-3.

[3] Andiani, D., Hajizah, M. N., & Dahlan, J. A. (2020). Analisis Rancangan Assesmen Kompetensi Minimum (AKM) Numerasi Program Merdeka Belajar. *Majamath: Jurnal Matematika Dan Pendidikan Matematika*, *4*(1), 80–90.

[4] Ardi, A. H. N. (2021). *Teknik Multimedia dan Animasi*. UNP Press.

[5] Dedrick, R. M., Guerrero-Bustamante, C. A., Garlena, R. A., Russell, D. A., Ford, K., Harris, K., Gilmour, K. C., Soothill, J., Jacobs-Sera, D., Schooley, R. T., Hatfull, G. F., & Spencer, H. (2019). Engineered bacteriophages for treatment of a patient with a disseminated drug-resistant Mycobacterium abscessus. *Nature Medicine*, *25*(5), 730–733. https://doi.org/10.1038/s41591-019-0437-z

[6] Devi, N. L. N. S., & Suartana, I. W. (2014). Analisis Technology Acceptance Model (Tam) Terhadap Penggunaan Sistem Informasi Di Nusa Dua Beach Hotel & Spa. *E-Jurnal Akuntansi Universitas Udayana*, *6*(1), 167–184.

[7] Ducrot, J., & Shankararaman, V. (2015). Targeted blended learning through competency assessment in an undergraduate information systems program. *Proceedings - Frontiers in Education Conference, FIE*, *2015*. https://doi.org/10.1109/FIE.2015.7344066

[8] Erawan, L., Susanto, A., & Winarno, A. (2015). Rekayasa Model Sistem Informasi Web Sertifikasi Kompetensi Di Lembaga Sertifikasi Profesi Menggunakan Metodologi Modeldriven UWE (UML-Based Web Engineering). *Prosiding SNATIF*, 297–302.

[9] Erawan, L., Susanto, A., & Winarno, A. (2017). Rekayasa Layanan Sertifikasi Kompetensi LSP Mika Dengan Sistem Berbasis Teknologi Informasi Dan Web. *Techno.Com*, *16*(2), 132–143. https://doi.org/10.33633/tc.v16i2.1266

[10] Handayani, W. P. P., & Harsono, M. (2016). Aplikasi Technology Acceptance Model (Tam) Pada Komputerisasi Kegiatan Pertanahan. *Jurnal Economia*, *12*(1), 13. https://doi.org/10.21831/economia.v12i1.8415

[11] Irmawati. (2017). *Otomatisasi Dokumen Asesmen Pada Lembaga Sertifikasi Profesi*. *November*, 144–149.

[12] Iswahyudi, P., Wijayati, D. T., Soedjarwo, S., & Hartono, S. (2019). Influence of graduation quality and flight training as a vocational school on international standard job opportunities. *TEM Journal*, *8*(4), 1456–1460. https://doi.org/10.18421/TEM84-50

[13] Lau, P. L., Abdullah, H. S., Chew, F. P., & Khan, A. (2011). The Effectiveness of Career Exploration Program for High School Students. *International Conference on Humanities, Society and Culture IPEDR*, *20*, 226–230.

[14] Levett-Jones, T., Gersbach, J., Arthur, C., & Roche, J. (2011). Implementing a clinical competency assessment model that promotes critical reflection and ensures nursing graduates' readiness for professional practice. *Nurse Education in Practice*, *11*(1), 64–69. https://doi.org/10.1016/j.nepr.2010.07.004

[15] Mwangi, A. (2020). *Assessing the Readiness Index of the Private Sector to Effectively use 5G Assessing the Readiness Index of the Private Sector to Effectively use 5G Technology in the Urban and Peri-urban areas of Kenya . June*.

[16] Sayekti, F., & Putarta, P. (2016). Penerapan Technology Acceptance Model (TAM) Dalam Pengujian Model Penerimaan Sistem Informasi Keuangan Daerah. *Jurnal Manajemen Teori Dan Terapan| Journal of Theory and Applied Management*, *9*(3). https://doi.org/10.20473/jmtt.v9i3.3075

[17] Setiawan, A. R. (2019). Literasi Saintifik Berdasarkan Kecerdasan Majemuk dan Motivasi Belajar. *Media Penelitian Pendidikan : Jurnal Penelitian Dalam Bidang Pendidikan Dan Pengajaran*, *13*(2), 126. https://doi.org/10.26877/mpp.v13i2.4913

[18] Sikandar, H., Abbas, A. F., Khan, N., & Qureshi, M. I. (2022). Digital Technologies in Healthcare: A Systematic Review and Bibliometric Analysis. *International Journal of Online and Biomedical Engineering*, *18*(8), 34–48. https://doi.org/10.3991/ijoe.v18i08.31961

[19] Sikandar, H., Vaicondam, Y., Khan, N., Qureshi, M. I., & Ullah, A. (2021). Scientific Mapping of Industry 4.0 Research: A Bibliometric Analysis. *International Journal of Interactive Mobile Technologies*. https://doi.org/10.3991/ijim.v15i18.25535

[20] Sukardi, S., & Soenarto, S. (2015). Asesmen Instalatur Listrik Berbasis Kebutuhan Industri Jasa Konstruksi Ketenagalistrikan. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *19*(2), 202–216. https://doi.org/10.21831/pep.v19i2.5580

[21] Sukma, E. A., Hadi, M., & Nikmah, F. (2019). Pengaruh Technology Acceptance Model (Tam) Dan Trust Terhadap Intensi Pengguna Instagram. *Jurnal Riset Ekonomi Dan Bisnis*, *12*(2), 112. https://doi.org/10.26623/jreb.v12i2.1659

[22] Triyono, T., Dwi Febriani, R., Hidayat, H., & Nora Dwi Putri, B. (2019). Pelatihan Penggunaan Teknologi Informasi Kepada Guru Bimbingan Dan Konseling. *Wahana Dedikasi : Jurnal PkM Ilmu Kependidikan*, *2*(1), 71. https://doi.org/10.31851/dedikasi.v2i1.2829

[23] Vaicondam, Y., Sikandar, H., Irum, S., Khan, N., & Qureshi, M. I. (2022). Research Landscape of Digital Learning Over the Past 20 Years: A Bibliometric and Visualisation Analysis. *International Journal of Online and Biomedical Engineering*, *18*(8), 4–22. https://doi.org/10.3991/IJOE.V18I08.31963

[24] Van, N. T., Irum, S., Abbas, A. F., Sikandar, H., & Khan, N. (2022). Online Learning—Two Side Arguments Related to Mental Health. *International Journal of Online and Biomedical Engineering (IJOE)*, *18*(09), 131–143. https://doi.org/10.3991/IJOE.V18I09.32317

[25] Vinanda, A. R., Wicaksono, S. A., & Amalia, F. (2019). Pengembangan Sistem Informasi Asesmen Lembaga Sertifikasi Profesi Berbasis Web (Studi Kasus : SMK Negeri 4 Malang). *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *3*(6), 6220–6229.

[26] Yuan, J., Gao, J., Li, X., Liu, F., Wijmenga, C., Chen, H., & Gilissen, L. J. W. J. (2013). The tip of the "Celiac Iceberg" in China: A systematic review and meta-analysis. *PLoS ONE*, *8*(12). https://doi.org/10.1371/journal.pone.0081151

[27] Zainal, A., Priyatni, E. T., & Widiati, N. (2018). Instrumen Asesmen Berbasis Higher Order Thinking Skills dengan Memanfaatkan Kumpulan Cerpen Filosofi Kopi untuk Kelas X. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *3*(13), 1561–1571.

7 Authors

Dony Novaliendry is with Universitas Negeri Padang, Padang, Indonesia and National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan (email: dony.novaliendry@ft.unp.ac.id).

Ahyanuardi is with Universitas Negeri Padang, Padang, Indonesia. (email: ahya5216@ft.unp.ac.id)

Irma Yulia Basri is with Universitas Negeri Padang, Padang, Indonesia. (email: irmayb@ft.unp.ac.id)

Noper Ardi is with Politeknik Negeri Batam, Batam, Indonesia. (email: noper-ardi @polibatam.ac.id)

Nathasyah Utami Hakim is with Universitas Negeri Padang, Padang, Indonesia.

Muhammad Fadilh Putra Pratama is with Universitas Negeri Padang, Padang, Indonesia. (email: fadilputra79@gmail.com)

Nenny Mahyudin is a lecturer in the Department of Early Childhood Education, Faculty of Education, with Disciplines including Educational Psychology, Developmental Psychology, Clinical Psychology, Educational Assessment, Educational Technology, Pre-school Education. (email: nennymahyuddin@ fip.unp.ac.id)

Article submitted 2023-01-13. Resubmitted 2023-02-27. Final acceptance 2023-02-28. Final version published as submitted by the authors.