Siakama Application to Enhance the Work Competency of Students in the Industrial Field Experience Program

Nizwardi Jalinus, Henny Yustisia, Rizky Ema Wulansari

Faculty of Engineering, Universitas Negeri Padang, Indonesia

***Abstract* - This research has several objectives. First, it aims to produce Student Academic System Applications (Siakama) which is specifically for thethe industrial internship bbased on the Industrial Revolutionial Revolution 4.0. Second, the current research also aims to describing the effect of Siakama Application. Furthermore, the type of the study was rresearch and ddevelopment. Siakama Application was developed using a procedure based on the Four-D development model. The validation process was conducted in two stages:; those are internal validation and external validation. Then, data analysis was carried out in two stages, including the stage of development and testing. This research resulted in the form of the development model of the the Industrial Field Experience Program base on Siakama Application which is a tool for operating and launching the Industrial Revolution 4.0 and the supporting products produced that have been declared valid, practical, and statistically effective.**

***Keywords* - application, industry revolution, industrial internship, Siakama, research.**

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Corresponding author: Henny Yustisia
Universitas Negeri Padang
Email: *hennyyustisia@ft.unp.ac.id*

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1. Introduction

During the Industrial Revolution 4.0, entire life encounters the phenomenon of disruption, which is the replacement of the old system to a new system based on technology, including education, such as the Internet of Thing (IoT), Big Data, Technical Assistance (Robotic), Artificial Intelligence, and Disruptive Innovation. In this case, the disruptive innovation for job opportunities competitiveness will increase and the risk of resources replacement from human to machine power (robotic) is inevitable [1].

At the National Work Meeting held at Indonesian universities, the Minister of Education explained the importance of elements that they will be focusing on motivating the improvement of the economy and the competition in RI 4.0 era. More innovative teaching and learning planning at higher education which is adjusting the curriculum and improving students' abilities of Data Information Technology, Operational Technology, Internet of Things and then Big Data Analytics. All this is in order to produce the higher education graduates who can compete and are skilled. The second element is the restoration of higher education regulations that are adaptable and sensitive to the RI 4.0 to develop various study programs. This includes the implementation of Cyber University programs and distance learning, which minimizes the meetings between the lecturer and student. In the future, it becomes a resolution for citizens living in rural areas to get higher education quality. The third element is to provide educators and researchers with a dedicated workforce that is responsive, adaptable and tested to face Industrial Revolution 4.0. This national working group is therefore expected to be able to make recommendations on the development of science and technology for higher education in the face of Industrial Revolution 4.0.

Students who have completed their education in higher education get inadequate knowledge for them to find work. Stakeholders will demand expertise in practical fields, which students can immediately enter the world of work. In Indonesia, a prominent problem regarding human resources is the inadequacy of the available job opportunities for higher education alumni and the error in the allocation of resources, such as the mismatch between the labor market and the world of education. This is also implied in the statement stated by the Director-General of the Ministry of Labor and Transmigration that 70% of the workforce is unable to meet the qualifications of the available job vacancies. Along with this statement, the Minister of Labor and Transmigration added that the reason for not filling the job vacancies is due to a mismatch between the needs and the existing manpower due to the gap in skills and education.

The vocational education has proposed a program to connect and coordinate the worlds of education and industry to overcome unemployment among vocational school graduates. This link and match program aim to obtain competent alumni in accordance with the employment demand in the industry. It is expected that the educational focal pattern that was originally supply-minded changes into demand-minded (market demands). Additionally, the program has a dual purpose: high school and higher education. Particularly for senior high school level, government program target is in the forms of changing the proportion of senior high school (SMA) vs vocational high school (SMK) students from 70:30 to 30:70. Meanwhile, at the higher education level, it is expected that the industry will take a role in creating special trainings and even join forces to establish synchronous institutions in accordance with the type of industry being developed. In addition, the renewal dimension includes if there were many SMK graduates who were unemployed due to their skills incompatibility according to the needs of the company (supply-driven), then it is expected that the future SMK graduates will have competence as needed by the industrial world (demand-driven). Furthermore, it is also expected that the government can make regulations for the industrial and labor market (EDUKA) where the industry is responsible for the educational world [2].

In the case of implementing the link and match program, the universities collaborate with industry in implementing Industrial Field Experience (IFE) Program or as called by the internship, that is one out of campus learning activity.

Students are required to carry out IFE organized by the Industrial Relations Unit (IRU) with the purpose of improving knowledge, skills and attitudes of students in technology/vocational field through direct involvement in various activities in the industry [3]. The implementation of IFE in each vocational higher education has been in accordance with the National Qualifications Framework (QNF), to which the determination of academic education graduates' competencies, vocational education, and professional education are oriented [4].

Students are obliged to participate in IFE in order to apply the knowledge they have learned. During IFE, students will know what the real world of work is like, in which they will be involved later after graduation. IFE intensively balances the abstract realm of theoretical knowledge as opposed to practical experience. The results of industrial training are to establish the relevancy to their skill and knowledge, which then improves their professional skills and competency development in engineering careers.

In this case, the students are obliged to participate in IFE which is managed by the Industrial Relations Unit (IRU), with the aim of increasing students' knowledge, skills, and attitudes in the technology/vocational field through direct involvement in various activities in the industry. During the implementation of IFE, students will apply, strengthen, prove the theories obtained in lectures and then put them into practice in the real workplace with the aspects of preparation, safety, accuracy, and work steps. Students, who will participate in IFE, will be provided with prerequisite courses and coaching by the universities. In this case, based on the curriculum analysis in Universities in Indonesia, it was found that the curriculum in prerequisite courses before students participated in IFE was sufficient as initial capital for these students to be directly involved in the industry [5]. The implementation of IFE in every university is in accordance with the National Qualifications Framework (NQF), where this is the main criterion to determine the competences of graduate on academic, professional and vocational education.

Based on the data issued by the Chief of IRU, there were 68% of students who were passed to carry out IFE in the period of March 2017 and 80% students in October 2017 80%, so it can be concluded that not all students who submitted an IFE proposal passed. The students who do not have the opportunity to participate in IFE face numerous obstacles, such as having their applications rejected by the industry or being unable to find a place to conduct IFE.

In this case, the students who do not have the IFE opportunity, causing them having a longer study period since IFE is a compulsory subject at the faculty level. During the monitoring and evaluation stage of students who participated in IFE by the educational supervisor, there is dissatisfaction from the industry towards IFE students, such as students are less active and do not participate in the industry activities, students do not understand how to complete tasks given by industrial supervisor. Since some students could not adjust themselves to being disciplined in industry, they were sent back to campus before they completed their internship, which indicates that students are not serious and just participate in IFE for formalities.These problems will disrupt the good relationship between universities and industry, and the industry will reconsider accepting IFE students in the future. The occurrence of student problems in the industry can actually be solved if there is good communication and coordination between the educational and industrial supervisors because the success of students in implementing IFE is very dependent on the cooperation between the educational and industrial supervisors [6].

The IFE currently managed by Industrial Relations Unit in which students can register to participate in IFE through the application of Information System in the Siakama application, students register for IFE coaching, register the company where they will conduct their IFE, get an educational and industrial supervisors and finally get a Letter of Assignment to participate in IFE.

In line with the demands of R.I 4.0, where the supporting facilities are more focusing on virtual equipment, then the function of Siakama application has to be optimized. At the stage where the students start the IFE, there are no more services provided on the Siakama application, so the communication and coordination system cannot be performed anymore. Students start their participation in IFE with the permission of their educational supervisors,while their participation in the industry is under the guidance of industrial supervisors. This condition sometimes makes students confused because they do not understand what position and activities they will do in the industry [2]. Seen from the availability of the Siakama application, there is a lack of features provided, where those who can interact on the Siakama application are only students, IFE coordinators, and IRU coordinators, while educational and industrial supervisors cannot involve in the interaction even though it is both the educational and industrial supervisors who determine the success of students during IFE. So far, students have been looking for companies to conduct their IFE by themselves.

Students often have difficulty getting information about projects so they are delayed in implementing IFE.

There were some weaknesses found in the IFE program due to several problems and backgrounds mentioned above.This problem needs to be addressed immediately by developing the Siakama application, through Development Model of Industrial Internship Program based on Siakama Application. The development of the new Siakama application was obtained by conducting research to produce program improvements that were in accordance with the IFE goals, and all problems that arose during the current IFE program could be overcome. The development of an application-based IFE program model is expected to help students, educational and industrial supervisors, and industry parties as well in order to achieve the objectives of implementing IFE, achieving Industrial Revolution 4.0 competencies that are in line with industry demand, and getting links for students to IFE and if they have graduated to work in the industry [2].

2. Research Method

This research was conducted in Universitas Negeri Padang (UNP) through Research and Development or Educational Design Research. According to Borg and Gall, Research and Development (R&D) is the process of developing and validating educational products. The development of the industrial internship program model uses a procedure proposed by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel (1974) based on his four-dimensional development model [7]. This model consists of 4 development stages; those are Define, Design, Develop, and Disseminate as shown in the following Figure 1.

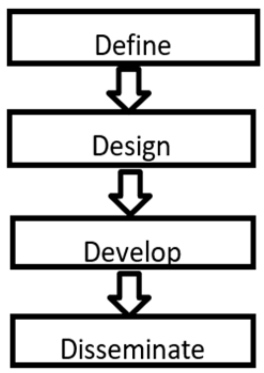

Figure 1 4D Development Model Framework

The research and development of Siakama application was conducted through several stages of:

2.1 Define

This stage begins with a preliminary study by conducting a needs analysis. Needs analysis is the first step in the research and development. This stage aims to emerge and define the basic problems encountered in the development of the Industrial Internship (IFE) so that an IFE model based on the RI 4.0 is needed. In order to maximize the process of developing the IFE Program model, it is necessary to analyze the needs of the business and industrial world as stakeholders, in this case construction service providers (contractors) and construction consulting service providers (consultants).

2.2 Design

In this design stage, research products are designed. The products designed are 1) the instrument of IFE Special Siakama Application based on theoretical concepts that have been obtained from the results of literature studies and expert experience, 2) designing application manuals, and designing instruments to measure the effect of products developed.

2.3 Develop

This developmental stage aims to carry out validity, practicality, and effectiveness of the Siakama application. During the validity test, the validators were required to give opinions regarding the manual and the Siakama application. Design validation is the active process of determining whether a rational product design is more effective than a conventional product design. Design validation can be done by conducting discussions with experts in FGD (Forum Group Discussion) activities. If a design weakness is found, then it is corrected. If according to the validator a revision has to be made, then a revision is made to the research product that has been developed. If all research products are valid, then all of these products are used for research products trials.

2.4 Disseminate

During this stage, product improvement is promoted in order that it is able to be common via way of means of users, each people and groups/systems. Before students carry out IFE, socialization is carried out on the 'Development IFE Base on Siakama Application' to students, educational and industrial supervisors. Furthermore, the new IFE Program is implemented for IFE students in January – June 2021.

Siakama application can be disseminated in national and international journals.

2.5 Product Trial

After the IFE Base on Siakama Application developed was validated and revised by the material experts and model development experts in order to obtain a fit and good product/model, the model was further tested. This experiment was carried out to collect information on whether the model is more effective than traditional models. Therefore, the test was conducted by concerning on its effectiveness on students who have returned from IFP where these students have used the Siakama application developed. The analysis also concerns the output model where students have obtained 21st century competencies, called 4C, including communication, collaboration, creativity and critical thinking.

The product trial was conducted on 20 students or 4 IFE groups, while the study was conducted on 30 students. This product trial was conducted to collect data that can be employed to identify the level of validity, practicality and effectiveness. In order to produce a good product, it is necessary to evaluate or test the product designed, so that the advantages and disadvantages can be described [8].

The validity test was conducted by experts to see the validity of the Development IFE Base on Siakama Application along with other supporting device products for the developed model. A product can be declared valid if it is developed with an adequate theory which is commonly referred to as content validity and all product components are interconnected consistently which is often referred to as construct validity [9].

On the other hand, we also conducted a hands-on test to confirm the usability and practicality of the developed product. Utility tests are metrics related to the usefulness of a product from the results of users or user reviews. A product is considered practical if it is user friendly.

Furthermore, the effectiveness test is the last stage in product trial. The effectiveness test is carried out to measure the suitability between the product produced and the objectives. The effectiveness aspect is very important in development, because it allows us to know the level of application of a theory or model in a particular circumstance. The test method of a product effectiveness refers to the level of consistency of experience towards goals [10]. Meanwhile, products designed should be consistently implemented between the expectations and reality.

Hence, this trial was carried out by looking at the effectiveness of students who have returned from IFE where these students have implemented the Siakama application that has been developed.

The analysis also concerned the output model where students have obtained 21st century competencies, called 4C, those are communication, collaboration, creativity, and critical thinking [11].

2.6 Research Participant

The trial of the IFE based on Siakama application development model was carried out on D-3 civil engineering students and undergraduate students of Universitas Negeri Padang who were enrolled in IFE at January-June 2021 semester. The subjects involved in this study were:

Subjects of expert respondents at the construct validation stage: the experts who were asked to validate the constructs of the IFE program development model were vocational technology education experts, civil engineering experts, language experts, and information technology experts. These experts validated the constructs of the developed Model, User Manual for the Siakama application, and the Siakama application. This expert trial was carried out in the form of FGDs.

Content validation is based on an existing design. Therefore, the subject consists of experts in the field of vocational technology education, civil engineering, and users. The subjects of the limited trial of the development of the IFE program model were 20 students who were enrolled in IFE courses. These 20 students were chosen because the subject-taking stage has aspects in each group in research and development which is based on the heterogeneity of intelligence or student learning outcomes [12]

In general, the test subjects were the students of the D-3 Civil Engineering Study Program and students of the Building Engineering Education UNP who enrolled in IFE courses in January-June 2017 semester as many as 30 people.

2.7 Research Instrument

The primary data was taken in this study, because it is obtained directly from the research subjects, who are experts, students, and IFE supervising lecturers. In this case, the quantitative data in the form of 1) data on the validity of the Siakama application, 2) data on the validity of the user manual for the Siakama application, 3) data on the practicality of product developed and 6) data on the effectiveness of the development IFE base on Siakama Application.

All instruments were developed based on the theoretical studies, main indicators, and realized in research instruments of questionnaires, fulfilment formats, observation sheet, documentation, etc. Instruments were further developed and tested. All instruments to be used were validated first by experts as presented in Table 1:

Table 1 Research Data Collection Instrument

No	Type of Data	Data Source	Data Collection Instrument
1	Defining Data	Supervising lecturer and students	Questionnaire
2	Validity data on Siakama Application	Validator	Questionnaire
3	Validity data on the industrial supervisors' siakama manual app	Validator	Questionnaire
4	Validity data on students' siakama manual app	Validator	Questionnaire
5	Validity data on educational supervisor's siakama manual app	Validator	Questionnaire
6	Practicality Data	Supervisor and students	Questionnaire
7	Effectiveness Data	Supervisor and students	Questionnaire

2.8 Data Analysis Technique

Data analysis techniques include data analysis of Siakama application developed and experimental data analysis. Analysis of Siakama's application development data was conducted by testing the validity of the instrument and the validity of the developed product using Aiken's V coefficient. Meanwhile, the analysis of experimental data concerns the validity and reliability of the tests used.

The results of practicality questionnaire were statistically processed by tabulation technique by determining the total score, average score, ideal score, and percentage of respondents' achievement level (TCR). The effectiveness test is conducted to measure the suitability between the product produced and the objectives. The effectiveness aspect in development is very important to know the level of application of a theory or model in a particular situation.

The test method of a product's effectiveness refers to the level of consistency between experience and objectives. Meanwhile, the implementation of products designed should be consistent in the case between expectations and reality [8]. The level of effectiveness can be interpreted as the level of user appreciation in learning or using the product, and the desire to continue using the product.

Data analysis technique of validity, practicality, and effectiveness can be seen in Table 2.

Based on this, the effectiveness of the product developed was tested by looking at the results of the product with the objectives to be achieved. An effectiveness sheet in the form of a questionnaire contains a statement to see the suitability of the product results with the objectives. Meanwhile, the effectiveness was determined through descriptive statistical analysis with the percentage formula then converting from quantitative to qualitative data.

Table 2 Data Analysis Technique

No	Variables	Measurement
1	Validity Aspect	Aiken's V Coefficient
2	Practicality Aspect	percentage of respondents' achievement level
3	Effectiveness Aspect	Level of consistency between experience and objectives

The development plan was planned after the needs analysis was obtained so that the stages needed to overcome the existing problems are known. The development plan consists of a) theoretical development model, b) student IFE manual, d) supervising lecturers IFE manual, e) industrial supervisor IFE manual, and g) Siakama Application, presented in front of information technology experts, vocational technology experts, and civil engineering expert in an FGD. This FGD resulted in a hypothetical development model, improvements to product development, and improvements to the instruments to be used.

3. Result

The results of this study are the Siakama application software that has been developed and the results of its validity, practicality, and effectiveness tests.

3.1 Siakama Application Software

Industrial Field Experience (IFE) Program based on Siakama Application is developed starting from the IFE submission stage to the industry and at the IFE implementation stage, or when students are already in the field. The development is by adding a new menu to student accounts and creating accounts for educational and industrial supervisors that are not featured in the application before. The account is aimed at communication with students and also for evaluating the progress of IFE students.

Before students submit IFE to the IFE coordinator of the Department, students have to make a learning plan containing their goals participating in IFE and the skills they want to acquire after participating in the IFE (Learning Objectives). The learning plan also contains the students' desired position during IFE (job position) and the job description they will carry out during IFE (job description).

When applying for IFE, students can login to the Siakama application. If student selects the 'Applying for IFE location' menu, an industrial name will appear for the student to apply for IFE, and the student can choose the IFE location on the companies listed in the application.

During the IFE implementation, students can choose 'Activity Report' menu, which is used to send reports on all activities carried out every day, which will be verified by the educational and industrial supervisors.

The educational and industrial supervisors' account can be utilized to find out the students' presence in the field and to conduct online communication. In Figure 2, we can see the flowchart of the Siakama application.

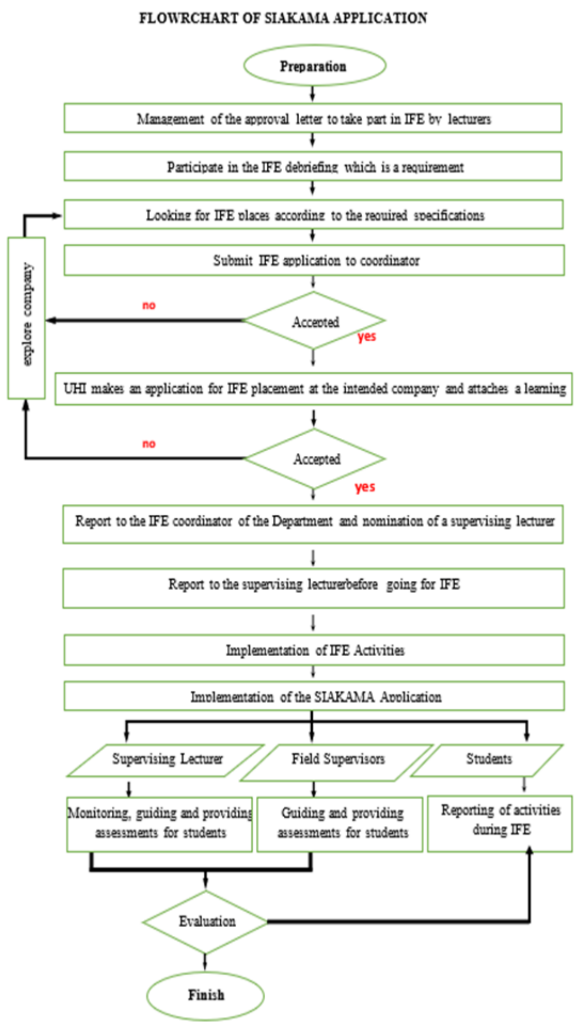

Figure 2 Flowchart of the Siakama application

3.2 Siakama Application Software Validity, Practicality and Effectiveness

The results of the analysis conducted by the experts regarding the validity of the product of the development of the IFE program based on the Siakama application are explained as follows:

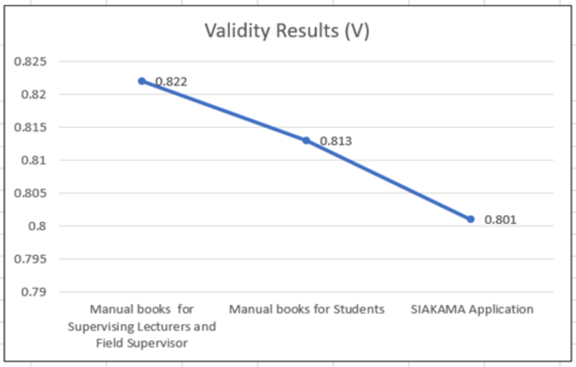

Figure 3 Results of Developed Product Validity

Based on the 3 stages of developed products in Figure 3, that is manual books for supervising educational and industrial supervisor, manual books for students and Siakama application, it can be seen that the Aiken V coefficient is above 0.667, which means that the development product is valid and can be tested. The practicality of the product for students is obtained from the results of the experimental questionnaire of 30 people involved.

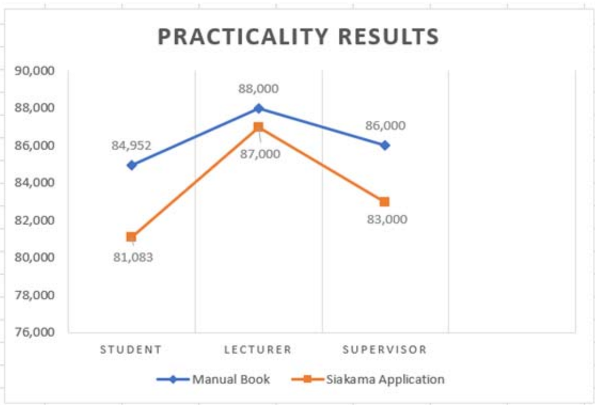

Figure 4 Results of Product Practicality

The results of product practicality developed of IFE for students, educational and industrial supervisors can be seen in Figure 4. Among the 2 products developed such as manual books and Siakama application, after a practical test, the TCR results were above 60%, meaning that after being tested, the product developed for students was in the very practical category.

Product practicality for IFE supervising lecturers is obtained from the results of an experimental questionnaire to 17 people involved.

Practicality of the products developed for IFE educational supervisor is obtained from the experimental questionnaire of 10 people involved.

The results of the effectiveness data analysis on development of IFE program based on Siakama application using the Excel program is explained through the description of the basic statistics of the research data in Figure 5:

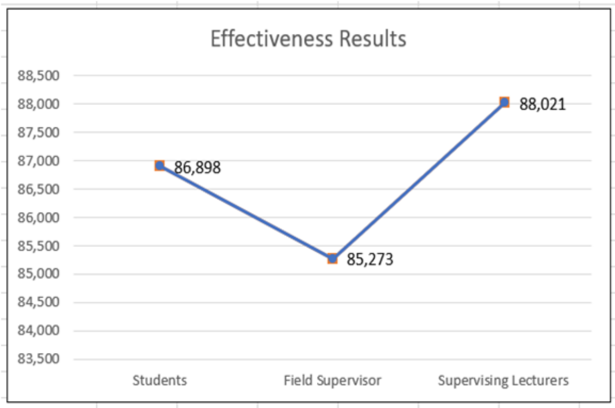

Figure 5 Effectiveness of Siakama Application

Based on the Figure 5, it can be stated that according to students, educational and industrial supervisors lecture, the average score for the effectiveness of the development of IFE program based on Siakama application generally ranges from 80 to 90, which means it is effective.

4. Discussion

In order to efficiently and effectively achieve the students' goals for IFE, the IFE model is equipped with the Siakama application which facilitates communication and coordination between the students, educational and industrial supervisors. The existing Siakama application only provides facilities starting from the IFE registration to the issuance of assignments for IFE students to the industry. Meanwhile, the developed Siakama application provides facilities when students have entered the field from the beginning until the IFE completes with the student's final score being given by the industrial supervisor. In the current development of Siakama application, educational and industrial supervisors accounts were added which had not previously been provided. In this case, by using the new Siakama application, administrative services become better and faster than manually, as well as can also increase collaboration significantly between industry and universities, it is in line with Narayanan research [13] which states that collaboration among industry and higher education can be optimal by optimal administrative services.

The IFE goals can be achieved from various activities they carry out during IFE, which can be recognized based on the students' daily reports uploaded on the Siakama website. Meanwhile, the students' competitions can be assessed by industrial supervisors and will then be communicated to the supervising lecturers via Siakama website on the chat menu. In the chat menu, educational and industrial supervisors can coordinate to each other for the progress and success of IFE students. The industrial supervisor assesses the achievement of student competitions through a final assessment rubric where the supervisor assesses the student's hard skills and soft skills competitions. The assessment is then directly sent to the supervising lecturers on the assessment menu in Siakama, and then they can discuss the student's competition achievements on the chat menu. The Siakama application specifically for IFE is very helpful in many ways related to the implementation of IFE starting from the beginning (coaching registration) to the end (uploading student scores). However, some things need improvement, for example data collection of students who have implemented IFE, until now the data on student names that can be seen by the IFE coordinator is only about 10% of the total number of students who have participated in IFE. There are also some controls that should be given to the IFE Coordinator (not just the Siakama admin), for example inputting the name of the supervising lecturers so that if there is a change (there is a new lecturer, the lecturer's academic title changes), adjustments can be made immediately.

The Siakama application is very practical and easy to use for beginners and can be accessed whenever and wherever students are. Students, educational and industrial supervisors are provided with an application manual so that they can follow the application stages. The Siakama application has the advantage that the educational supervisor can monitor IFE students in the industry every day based on daily reports posted by students, where students can send photo and video documentation according to their activities in the field [2]. In this case, the students suggest that photos and videos can be uploaded directly to the daily report, not by copying the link from Google Drive. It is a shame that the application cannot be done because the server does not provide a feature for it. The problem encounters when using the application is that sometimes IFE students are in areas with poor signal or even do not have signal at all, so this forces students to recap their daily reports when they get a signal.

Obstacle in using Siakama application is sometimes also encountered by industrial supervisors who are not familiar with the online system, because they do not have time to study the Siakama application which is a 'new knowledge' for them.

Students hope that this Siakama application can also be utilized when making the final report, considering the effectiveness of online guidance both with educational and industrial supervisors. Siakama application comes with an application user manual. From the practicality questionnaire, students stated that the manual made it easier for students in using the Siakama application because the language in the manual was very easy to understand and orderly.

Meanwhile, from the questionnaire on the effectiveness of the Siakama application specifically for IFE, the results obtained were very effective, which is in line with [9], which states technology can increase learning effectively. It facilitated reporting and also giving final scores from industrial supervisors to educational supervisor as well. The manual is quite clear and easy to use as a guide for using the Siakama application, but it needs to be socialized to industrial supervisors so that there is a common understanding of industrial supervisors supervising lecturers, and students.

Siakama application is also very practical for students to use, especially during a pandemic for monitoring and coordinating with students. It is supported by [2], which is application can be implemented effectively in learning while pandemic. By using the Siakama application, supervisors can review students' progress and students' attendance every day through daily reports uploaded by students. Furthermore, it is recommended that the application is equipped with a menu such as a video call, so that lecturers can communicate directly with the industrial supervisors and students.

5. Conclusion

This research resulted in a Development Model of Industrial Internship program base on Siakama Application which has novelty value as a tool for operating and launching the IFE Program based on the RI 4.0. In order to use the application, a supporting product is used the Siakama Application manual for students, industrial and educational supervisors. Siakama Application Specifically for IFE based on the RI 4.0 which was developed, and the supporting products produced have been declared valid, practical, and statistically effective.

This research contributes to the existing knowledge that can be alternative for other higher education and vocational high school in implementing industrial internship. This study has not been tested to other variables yet, just only tested on validity, practicality and effectiveness. The limitation of this study can be a suggestion for the further researcher.

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