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Mobile Learning Innovation: Android-Based *Smart Informax* Development to Optimize Practicing Vocational School Students in Industry

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Abstract

The application of innovative technology in learning can enhance the competence of students which corresponds to the needs of the world of work and industry. The aim of this study is to create an Android-based learning media—also known as a smart informax realized in an application that can be accessed using a smartphone. This application supports project-based learning even if students are in the process of internship in industry. It can be used anywhere, in school, out of school or students in field work practice (PKL). This application is designed to suit the needs of students in the world of work and industry. The development of this application uses R&D methods adapted to the ADDIE development model. There are five stages of development: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation. This study involved 30 students of grade X majoring in computer network engineering at SMKN 1 Tanjungpinang as research participants. This study used observation and questionnaire as data collection techniques. The descriptive data collection method used by materialists and media experts is the Likert scale which has four options of answers. The material expert evaluation results obtained a total score of 98.00 with an average score of 3.62 out of 27 evaluation indicators with a percentage of 90.74%, so it belongs to the category very suitable for use. With a positive student response with an average of 92.67% at the media implementation stage, this falls into a highly qualified category. Evaluation results of application use by students showed an average improvement of about 43.74% in student learning outcomes. This smart informax application is specially designed to support project-based learning to improve student competence and student skills in industry-based projects that will affect student performance during their internship in the world of industry.

Keywords: ADDIE, Industry, M-Learning, Smart informax, Smart phone, vocational

1. Introduction

Information Technology (IT) has transformed the world of education, opening up new opportunities and posing challenges that need to be addressed immediately. The rapid development of the IT world, especially in the era of the Industrial Revolution 4.0, has driven the integration of technology in education. The use of IT has changed the way in education and learning. In the book "Handbook of Research on Educational Communications and Technology", Zhao et al. (2002) state that IT mergers create environments that enable students to participate more actively, enhance understanding of concepts, and encourage interactivity. According to Ertmer and Ottenbreit-Leftwich, (2010) in the journal "Teacher Technology Change: How Knowledge, Confidence, Beliefs, and Culture Intersect", increasing the role of IT as a learning medium has proven crucial to building students' skills that fit the demands of the 21st century and the 4.0 Industrial Revolution. More personalized and adaptive learning can now be achieved through technological advances such as artificial intelligence and project-based learning. (Mishra & Koehler, 2006; Siemens, 2005).

Several educational theories and learning concepts support approaches that emphasize the integration of learning technology with the world of work and industry. One of the most important theories is the theory of contextualization of learning arguing that materials and skills are taught in contexts relevant to real life and work. Contextual learning allows students to use their knowledge and skills in real-world contexts, enabling students to prepare themselves for living and working (Brown, J. S., Collins, A., & Duguid, P, 1989).

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By using technology, students should not only acquire academic knowledge but also skills that fit the needs of the industry. The use of technology in learning must be designed to describe the processes and tools that exist in the world of work. Applications, online platforms, and technology-based learning tools have created new fields where students can interact with the material in a more appropriate and targeted way. Skills like creativity, problem-solving, and collaborative skills are vital for the present and the future. Therefore, the use of information technology as a learning tool is becoming increasingly important as it helps students learn to think critically and creatively as well as obtain information. The industrial world often involves technology and innovation. Students need to have competence in the use of technology and the ability to innovate to compete (Trilling, B., & Fadel, C. 2009). Emphasis on student competences related to the world of work helps produce graduates who are not only knowledgeable but also ready to be productive contributors in a variety of industries.

Information technology enables the development of essential skills needed by students in the future. P21 (Partnership for 21st Century Learning, 2007) mentions some skills that will be needed in the 21st century, such as creative thinking skills, problem-solving, information literacy, and teamwork. The development of these skills is supported by the integration of information technology into learning. (Keengwe et al., 2014). Smart Informaxs, also known as "Smart Informaxs", are educational technology innovations that use sophisticated devices to enhance students' learning experiences. In the modern learning world, using Smart Informax is not only a luxury, but also a necessity to boost students' creativity, collaboration, and skills. Smart Informax enables deep technology integration into the learning process, creating an environment in which students can develop 21st century skills such as problem-solving, critical thinking, and digital literacy (Zhao et al., 2002; Partnership for 21st Century Learning, 2007). Through the use of smart devices and educational applications, students can learn more interactively and respond to information in a more dynamic way.

A platform created to encourage students to become creative through the implementation of Smart Informax. In his book "Mindstorms: Children, Computers, and Powerful Ideas", (Papert, S. 1980) says that Smart Informax gives students the opportunity to try out new ideas, create creative projects, and enhance their abilities in design and presentation. Smart Informax are perfectly suited to using a project-based learning model (Project Base Learning-PJBL) with a STEAM approach (Science, Technology, Engeneering, Art, Mathematics). The ability of Smart Informax to enable students to collaborate with each other is one of its main advantages. Group projects can be done quickly with online collaboration tools that allow students to collaborate virtually from different locations. It shows how important it is to work together in an increasingly connected work environment. (Keengwe et al., 2014). Smartphones have evolved into a multifunctional tool that is crucial in the transformation of learning media in the 21st century, characterized by technological advances. Using smartphones to access Smart Informax enables more interactive, dynamic, and connected learning. Smartphones enable flexible and personal learning access. With the presence of Smart Informax, students can access lesson materials, tasks, and learning resources through their smartphones anytime and anywhere. (Johnson et al., 2015).

Students can use their smartphones to interact and collaborate actively. The Smart Informax app, for example, gives them the opportunity to participate in collaborative projects, online discussions, and interactive learning activities. (Partnership for 21st Century Learning, 2007). The number of smartphone users in Indonesia is estimated to reach over 190 million by 2023. Today, Indonesia is the fourth largest smartphone market in the world after China, India, and the United States. Data Published by the Statista Research Department, 2 November 2023 on the statistika.com website (https://www.statista.com/forecasts/266729/smartphone-users-in-indonesia).

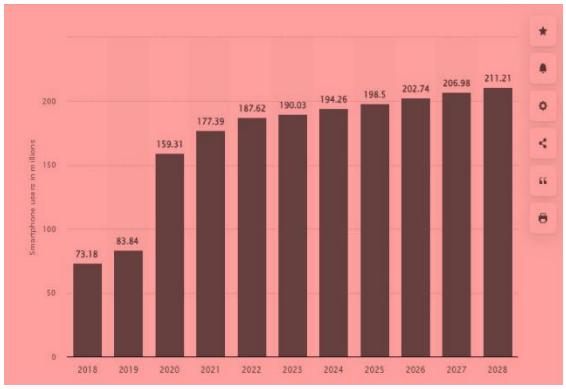

Figure 1. Smartphone user graph from statistika.com web page

Live field observations show that students use their smartphones only to talk, play music or videos, access online social media (Facebook, Twitter, Instagram, WhatsApp, and Telegram), and take swafoto. The most frequently done by students is playing games through their phones.

One of the problems that has occurred in this learning process is the lack of interactive learning media used in the learning process, which keeps students unmotivated to learn. Many learning media do not meet the needs of today's industry due to a lack of in-depth understanding of the demands of work and the required skills. Impact students graduate without having the skills required by the world of work, there is a gap between graduates and the needs of the industry. Besides, students have not

maximized the use of smartphones or mobile phones as a learning medium and lack of interest in reading textbooks, both printed and electronic. Students do not have adequate Android-based learning content that can be accessed through their smartphones; they only use it to send SMS, social media, play games, and watch videos on YouTube. The focus of the research is on how to design Smart Informax and make Android-based learning media accessible via smartphones; how to designing interactive learning media so students can engage in use; How to design applications that students can use when students are again interns in the industry; How do you design applications to support students doing project- based learning, How to enhance students' interest and motivation in learning processes inside and outside the classroom; and How to test the validity of learning media using android-based smartphones.

2. Methods

The aim of this research and development project is to design an Android-based learning media product called a Smart Informax which can be used to improve learning outcomes, improve student competence to support employment in the industrial world. Development uses the ADDIE model approach, developed by Robert Maribe Brach (Sugiono, 2015). The ADDIE method provides a systematic framework in the design and development of learning programmes. Through the phases of analysis, design, development, implementation, and evaluation, instructional designers can ensure that each learning element is carefully planned, developed, and assessed, creating an effective and relevant learning experience. The stages of ADDIE are:

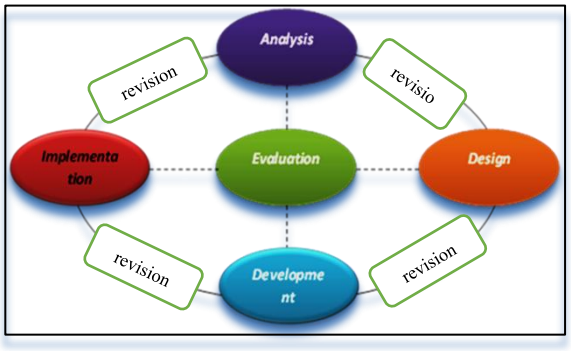

Figure 2. ADDIE Methods for Learning Product Design (Sugiono, 2015)

1) Phase Analysis
   a) Student needs analysis includes student characteristic needs for users of Smart Informax Applications, as well as hardware, and software needs.
   b) Competence and instructional analysis, which includes analysis of the Learning Goals (TP), Learning Goal Streams (ATP), and the teaching modules used in accordance with the independent learning curriculum to be loaded in the Smart Informax learning media.
   c) Although students often use their phones to communicate, send SMS, play games and access social media, they do not use them for learning media support or as a learning medium.
2) Phase Planning
   Designing learning activities is a major task at the design stage. It is a systematic process that begins with designing new ideas on paper, designing the development of new products (incentives for each learning unit) and designing design implementation guidelines. Any design made during the design phase will serve as a basis for the subsequent development process.
   a) Storyboard design for media
      Storyboards are a complete representation of the learning media that will be loaded into the application and serve as a guide.
   b) Determining Contents
      At this stage, determine the subjects that will be used as a Smart Informax learning medium, namely, Phase E Informatics, for 10th grade SMK students.
   c) Preparation of questions and answers for diagnostic, formative and summative assessments.
      This medium has materials, subjects, and discussions that are structured according to the curriculum and standard curricula applicable, i.e. using independent curriculums of learning.
   d) Relationship
      Smart Informax designed and developed have connections with learning web pages and industry web features.
3) Phase of Development
   At this stage, product design realization activities are carried out. These include creating products (materials or materials and tools) necessary for development, developing products based on product design, and creating rules to measure product performance. At the development stage, the conceptual framework that has been constructed at the design stage will be realized into ready-to-use products.
   a) Develop a Smart Informax learning media product for the Computer Science subjects: At this stage, learning media products are created with the help of IDE (Integrated Development Environment) software Eclipse, Android Studio, Visual Studio, Smart Apps Creator, html, and other supporting applications.
   b) Connect the Smart Informax application with other learning-supporting web.
   c) Validation by Media and Material Experts: Validations are carried out by material and media experts. Advice, comments, and

findings from this process can be used as a basis for media reviews and product testing.

4) Phase Implementation
   a) At this stage, 30 students of class 10 (X TKJ) of the Network Computer Engineering major undergo product testing. Students receive a lift, also known as a quizzer, used to measure the opinions or responses of learners about the applications created.
   b) Start using a new product in the classroom or in a real environment.
   c) Review objectives: product development objectives, student-student relationships, and initial feedback on the evaluation process.
5) Phase Evaluation
   At this stage, all stages of analysis, design, development, and implementation are evaluated. Some evaluation assessments include:
   a) Assess whether each step of the process and the product that has been made has met the specification.
   b) Assessing the impact of learning.
   c) Evaluate the level of achievement of product development objectives.
   d) Evaluate the results achieved by the target.
   e) Find any information that can help students better results.

2.1. Research Source Data

The research subjects involved in this study are 30 students from Class 10, Network Computer Engineering (X TKJ) SMKN 1 Tanjungpinang. A learning media expert, who studies the quality and feasibility of learning media (Smart Informax applications) which are the relevant aspects of the material, the organizing of the materials, the assessment evaluation aspects, the language, the impact aspects for learning strategies, the software aspects and the aspects. A media specialist, who researches and gives an assessment of the visual aspect of display, the engineering aspect of software, the aspect of language, and the impact aspect of learning strategy.

2.2. Research Engineering

In this study, the lifting tool was used to collect data from students, material experts, and media experts to evaluate learning media. The Likert scale with five choice answers is usually used to evaluate the educational media's validity very good, good, sufficient, little, and very little. However, in this study, a scale of four option answers was used. Each choice is scored, with very much agreement = 4, agree = 3, disagree = 2, and very much disagreement = 1. (Sugiyono, 2011).

The scale consists of two answers: yes-no, true, never-never, positive-negative, etc. If there is an input or recommendation on how to fix the product, then the recommendation will be reconsidered to improve the product even better.

2.3. Data Analysis Techniques

1) Data related to the product development process.
   Product development process data is descriptive data collected from material experts, media experts, and students with input and corrections used as references for product revisions.
2) Data used to assess the validity of the product by the expert.
   The result of the filling of the raft by media and material experts is used to obtain product quality assessment data, which is then analyzed using the following methods:
   a) Converting qualitative assessment to quantitative. Scoring maturity: For category strongly agree (SS) with score value 4. Category agree (S) with score value 3. Category disagree (TS) score value 2. And Category strongly disagrees (STS) scores value 1 (Eko Putro Widoyoko, 2011).
   b) Calculate the average score value of each indicator using the formula: X = average score = ∑X = total score / N = number of test subjects.
   c) Provides a qualitative interpretation of the number of percentages of scores for each component using the following criteria: Conversion formula scores the number of percentages:
      Value 4 with a score x ≥ Mi + 1.5 Sdi, criteria are excellent. Value 3 with a rating Mi + 1,5 Sdi > x ≤ Mi, criterion is good. Values 2 with a score Mi > x > Mi - 1.5 SDI, criteries are not good. (Lukman & Ishartiwi, 2014). Description: The ideal score ratio (Mi) = 1⁄2 (maximum ideal score + minimum ideal score), the ideal default deviation (Sdi) = 1/6 (maximal ideal score – ideal minimum score), actual score (x) = score obtained.
      The overall product eligibility criteria can be determined by multiplying the evaluation score by the number of indicators measured in each aspect evaluated by the formula: Percentage of eligibilities for each aspect (%) = ∑ ratio of scores obtained / ∑ rate of ideal scores multiplied by (X) 100%. (Suharsimi Arikunto dalam Rohmi Julia P, 2012).
      The collected data is analyzed with a quantitative descriptive analysis presented in the distribution of scores and percentages against categories with a specified scale of evaluation. The validity assessment of the percentage of the assessment is 76-100%, the interpretation is very decent. 50-75% is decent, 26-50% is sufficient and for a value below < 26% the interpretations are inadequate.
3) Student opinion data
   Student opinions are collected from a combination of closed and open lifts. "Yes" and "No" are other

options to answer questions in a closed lift. The following formula is used to calculate the percentage of each number: Percentage for each number (%) = Number of students answering yes divided by Total number of students once (X) 100%. Student response is considered positive when obtaining percentages ≥ 70%. On the closed lift section, data analysis is used using descriptive data analysis techniques (Khabibah dalam Heri Kiswanto, 2012).

3. Results and Discussions

Smart Learning Classroom media plays a key role in preparing students to work in the modern world of work and industry. With the integration of the latest technology, Smart Informax create learning environments that support the development of competences relevant to industry needs. Smart Informax leverage the latest technologies such as augmented reality, virtual reality, and other smart devices. This integration creates learning experiences that reflect the use of technology in the working environment.

It is beneficial for students to become familiar with the latest technology and understand how to apply it in the context of work. Smart Informax provide a collaborative platform that allows students to collaborate on projects, reflecting the need for collaboration in the workplace. Students develop the collaborative skills needed to work in teams and solve problems together.

This Smart Informax application supports a project-based learning model or known as Project Base Learning (PjBL). Project Base learning is an innovation in learning that emphasizes the participation of learners in learning, from the beginning of learning to the final learning activity. Pjbl emphasizes to the inner knowledge that the students have on the material that they learn. (Montessori., Ambiyar, 2023). Project-based learning (PJBL) is strongly supportive of the preparation of students to plunge into the world of industry, where this learning model is designed on the basis of projects to be done in industry and has industry standards, with the matching of curricula in schools with industry.

There are several previous research studies relevant to this study. Wulandari (2018) created an Android-based learning media for the basic algorithm and programming subjects for students of X SMK class. The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) is used using development and research modes. (Research and Development). This Android-based learning media is very useful, with an average score of 95.34% in the "Very Worthy" category for media experts, material experts, and student testing.

Rizki Agung S in 2014 created an Android-based learning medium for Circulation System material for students in the eleventh grade of high school. His development method uses the modified model of Thiagarajan 4D: Define (Definition), Design (Planning), and Develop (Pengembangan). Research results show that mobile learning media has been developed based on the evaluation of excellent media experts (98.46%), Excellent material experts (78.46%), excellent technicians (88.89%), and excellent student feedback (79.71%). Data acquisition results show that mobile learning media is worthy to be used as a learning resource for students in the eleventh grade of high school/MA.

In 2018, Muhammad Ihsaan F and Eko Marpanaji conducted development research to create an interactive book on IT and Communication for Class X SMEs. The study focused on the three phases of the Alessi and Trollip development process: planning, design, and development. To collect data, questionnaires for users, product validation sheets for media and material experts, and learning results tests are used. Qualitative and quantitative descriptive data is used to analyze it. Research results show that interactive e-books as ICT learning tools receive excellent scores in alpha and beta tests. Furthermore, effectiveness tests show that interactive e-book is more effective than conventional ICT learning approaches.

Based on the results of the three studies that have been carried out above, all of the research uses smartphones as a learning medium; however, the applications developed to support the learning process are still less complete and less interesting. A good learning medium is a learning medium that can enhance student skills, especially students' skills for performance in the industry. Learning media that can improve student learning outcomes, which makes it easier for students to master learning, which is connected to other learning media, interactive, has multimedia content, supports project-based learning, provides an exciting experience so that one day students can adapt more easily to technology or applications used by industry.

Project-based learning creates a collaborative environment in which students can work together, share ideas, and build knowledge together (Vygotsky, 1978). Using technology as a learning tool can enhance the project experience. Using design software, simulation, and smart devices can enrich learning and provide the technology perspective needed in the industrial world. (Koehler & Mishra, 2009). These technology projects provide an opportunity for students to develop specific technical skills related to a particular field of industry. The use of modern software and hardware equips them with the skills needed in the world of work (Gallagher, 1997).

Robert Maribe Brach developed the ADDIE model approach, which is an extension of Analysis, Design,

Development, Implementation, and Evaluation; the development model used refers to this approach.

3.1. Results of Analysis

a) Analysis of student needs, including student characteristics and hardware and software requirements (software). The students who use this Smart Informax application are Class X Students of Class Year 2025/2026 SMKN 1 Tanjungpinang, who use an independent learning curriculum to support computer science subjects.
b) Learning media applications that students can access through frequently used smartphones are the result of needs analysis. Live field observation results showed that the average student uses a smartphone with an Android operating system. Therefore, the Android-based learning media that can be accessed through smartphones is designed to support the learning process of Computer Science subjects.

3.2. Planning Outcomes (Design)

a) Media Design Manufacturing (Storyboard)
Storyboards provide an overview of the applications to be loaded and serve as maps to assist the media creation process. In this section will be set up the main menus of the application.

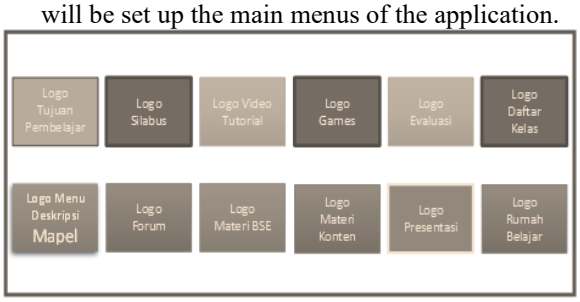

Figure 3. Smart Informax Storyboard Design

b) Design of the material menu on the Smart Informax

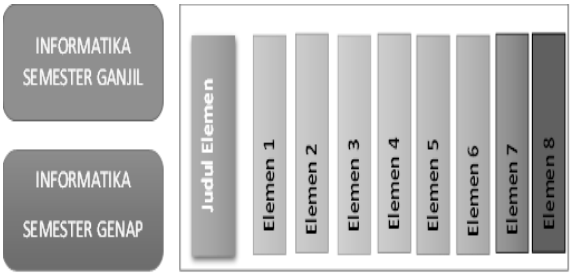

Figure 4. Informatics Element Material Menu

In this section will be designed learning material consisting of several elements and developed learning material to support the world of industry, so that students have the competence required by industry or learning material that has industry standards.

c) Menu Assessment Planning

Figure 5. Manu Assessment

In this assessment menu, this application can be used by students to perform assessments given by teachers and used by to facilitate assessments to students.

d) Relationship with other web pages
The logo button on the main menu allows you to create applications connected to other learning media. To foster skills even connections with the web industry. This menu includes forums, video tutorials, games, presentations, home learning, and virtual classes and others.

3.3. Development Result

a) Product Results Learning Media Smart Informax Applications

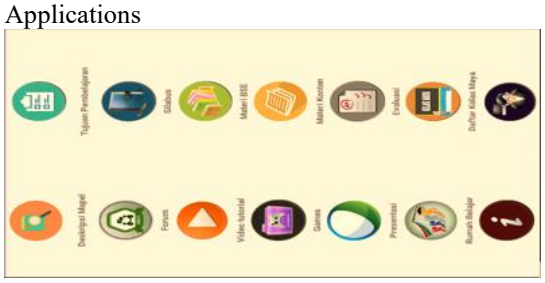

Figure 6. Play Smart Informax Menu

The image above is the main menu of the Smart Informax, from which there is an icon-icon sub menu that makes it easy for the user to access the other submenu pages. The user can choose a specific icon to enter it. There are several sub-menus that are attached inside such main menus including: Virtual classes, modules, electronic school books, video learning, learning games, forums, assessments/evaluations, absences, pharum, project planning menus and menus that have links to industry websites that have collaborated and others.

b) Results validated by the Material Expert
The following table shows the evaluation of the learning media of the material expert for the revision. The validation performed by the materials expert is by collecting their advice and opinions.

Table 4. Criteria for Expert Assessment of Materials

No	Indikator	Nilai	Kriteria
1.	Indicator of several Aspects	98.00	Very good.
Total Value		**98.00**	**Very good.**
Average		**3.62**	**Very worthy.**
Persentase		**90.74%**	

Based on the overall material expert assessment, the media received a total score of 98, with an average score of 3.62 out of 27 evaluation indicators, which indicates that the media belongs to an excellent category. The media also received a percentage score of 90,74%, which shows that it is a highly eligible category to be used as a learning media. an average score of 3.62 from 27 assessment indicators, which shows that the media is included in the very good category. The media also received a percentage score of 90.74%, which shows that it is a category that is very suitable for use as learning media.

c) Results validated by media experts
The following table shows the media learning evaluation of media experts for the revision.
Table 5 shows the criteria for the evaluation of media experts.

No	Indikator	Nilai	Kriteria
1.	Indicator of 4 Aspects	87.00	Very good and good
Total Value		**87.00**	**Very good**
Average		**3.78**	**Very worthy.**
Persentase		**94,58%**	

As a result of the overall media expert assessment, the media received a total score of 87.00 and an average score of 3.78 of the 23 rating indicators included the category is excellent, which indicates that the media belongs in the category excellent, with a percentage of 94.58% including the category highly eligible to be used as a learning media.
30 Grade 10 students of Network Computer Engineering (X TKJ) SMKN 1 Tanjungpinang filled a lift to evaluate the implementation of learning media. The elevator given to the student uses the Ghuttman scale with two choices of yes or no answers. The lift consists of ten combination questions. The following table shows the overall lifting answers.

Table 6. Recapitulation of the student's elevation assessment

NO	Indikator	Jawaban		Jumlah	Jumlah Persentase
		Ya	Tidak		
1	Dari 10 Indikator	278	22	300	926,74%

The table 6 above shows that each question received a "positive response" with an average of 92.67%, indicating that the Smart Informax application is highly eligible to be used as a learning tool.

d) Results of the evaluation
Measures the performance of a product created, i.e. by measuring the extent to which improved student learning processes and student skills in working on a project, which will affect student performance/skills as they descend into the real world of industry using the learning medium.

4. Conclusions

The focus of this research is an Android-based Smart Informax app that will be used by SMK students studying computer science in the 10th grade. Applications are created using the Research and Development method and the ADDIE development model, which includes phases of analysis, design, development, implementation, and evaluation. The aim of this study is to create an Android-based learning medium also known as a Smart Informax in the form of an application that can be accessed using smartphones, used by students as a learning medium to improve students' competence in the use of technology according to the needs of the world of work and industry. This app supports project-based learning even if students are in the process of internship in the industry. This app can be used anywhere, at school, outside of school or students in field work practice (PKL) in industry. Subjects of the test are 30 students at class 10 Network Computer Engineering SMKN 1 Tanjungpinang. The instruments used are Likert scale lifts for media and material experts, as well as Guttman scales lift for pupils. The validation results show that the Smart Informax application is highly worthy of use as a learning medium. Applications received a qualifying percentage of 90.74% of material experts and 94.58% of media experts, average student respondents received a positive response of 92.67%. Furthermore, media applications showed an improvement in average student learning outcomes of 43.74%. Therefore, it can be concluded that the Smart Informax application, which is made based on Android, is a good and effective choice as an interactive learning medium to enhance the interest and learning outcomes of SMK students studying computer science. The application is easy to use and meets 21st century learning standards.

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