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SiDal Development (Laboratory Big Data System) in Basic Physics Laboratory

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ABSTRACT

Inventory activities for tools and materials, borrowing tools, free laboratory processes and much more, are part of the Education laboratory services, in its function as a support for the Tri Dharma of Higher Education. These activities when carried out with conventional systems, require a long time with less-than-optimal results. To improve laboratory management services, a device data collection system was developed which is contained in a web-based application, called SiDal (Laboratory Big Data System). SiDal is a subsystem of the laboratory management system at the Basic Physics Laboratory of FPMIPA UPI. The aim of developing SiDal is for laboratory services to be more effective and efficient with optimal results. Users can access tool data, tool catalog, tool status and where to store the tool. To see the success of the system, research was carried out using the Research and Development method. Trials of the application of this system were carried out at the Basic Physics Laboratory of FPMIPA UPI by conducting surveys through questionnaires and interviews. From the results of the questionnaire distributed, 68 student respondents from various generations had accessed SiDal. 98% of respondents agreed that the implementation of SiDal in the Basic Physics Laboratory provided an increase in laboratory management services. The results obtained will serve as an evaluation and further development of the laboratory management system.

Keywords: Inventory, Laboratory, SiDal, Information system

ABSTRAK

Kegiatan inventarisasi alat dan bahan, peminjaman alat, proses bebas laboratorium merupakan bagian dari layanan laboratorium pendidikan dalam fungsinya sebagai penunjang Tri Dharma Perguruan Tinggi. Pengelolaan secara konvensional membutuhkan waktu lama dengan hasil yang kurang optimal. Upaya peningkatan layanan pengelolaan laboratorium telah dilakukan melalui pengembangan aplikasi sistem pendataan alat berbasis web yang diberi nama SiDal (Sistem Big Data Laboratorium). SiDal merupakan subsistem dari sistem pengelolaan laboratorium di Laboratorium Fisika Dasar FPMIPA UPI. Tujuan dari pengembangan SiDal adalah agar layanan laboratorium dapat menjadi lebih efektif dan efisien dengan hasil yang optimal. Pengguna dapat mengakses data alat, katalog alat, status alat berikut tempat penyimpanan alat tersebut. Metode penelitian dan pengembangan telah dilakukan dengan uji coba penerapan sistem melibatkan 68 responden mahasiswa di Laboratorium Fisika Dasar FPMIPA UPI. Hasil pengolahan data angket dan wawancara, ditemukan bahwa 98% responden menyatakan setuju bahwa aplikasi SiDal di Laboratorium Fisika Dasar berdampak positif terhadap peningkatan layanan pengelolaan laboratorium.

Kata kunci: Inventarisasi, Laboratorium, SiDal, Sistem informasi

INTRODUCTION

In 2020, Indonesian Minister of Education and Culture regulation concerning National Higher Education Standards also states that laboratories/studios/workshops/production units are one of the standard facilities and infrastructure that must exist in a higher education (Kemendikbud, 2020). In order to create a proper laboratory, it must be managed properly, one of which is by having professional and competent management officials related to the field and type of laboratory (Buska et al., 2020; Bai et al., 2022). The official can be a laboratory assistant, laboratory technician, laboratory administrator, or laboratory administrator.

Many studies have been conducted regarding laboratory management such as the use of online form (Asmoro et al., 2019), library-based applications (Sulistyo et al., 2021), Waterfall software (Kuncoro et al., 2018), RFID and web-based (Aminah & Sunarya, 2020), and the use of the codeigniter framework, by implementing the hierarchical model view controller architecture and supported by several programming languages such as HTML5, CSS3, JavaScript, PHP and MySQL (Henri et al., 2020). From the various research methods that have been carried out, it is implied that laboratory management must keep up with the times, where currently all services use online applications, both government services and commercial services.

Laboratory management activities include; 1) planning of laboratory activities, 2) operation of equipment and use of materials, 3) maintenance/maintenance of equipment and materials, 4) evaluation of laboratory work systems; and 5) development of laboratory activities (MenPAN-RB, 2019). These five elements are interrelated with each other, and are included in activities such as: servicing practicum, inventory of tools and materials, the process of borrowing tools, arranging laboratory free letters and others.

The point is that laboratory management must be carried out optimally and all elements must be carried out properly, for example a practicum activity will not run smoothly if the loan process is not carried out properly. The process of borrowing tools and materials will not be effective if the inventory of tools, data collection and arrangement of tools is still chaotic. Including tracing the history of borrowing students who will take care of free laboratories, requiring an integrated system of borrowing and data collection tools.

Like some of the problems encountered in laboratory management at the Basic Physics Laboratory (LFD), namely the conditions of the Covid-19 pandemic which limited direct contact (Shi et al., 2020) while the LFD is a laboratory with busy activities, because it serves 2 compulsory practicum courses, other subjects that require tool demonstrations, research and community service. The laboratory manager is limited, only 1 person, while the tools and materials that must be managed are around 800 tools/materials so that with a manual system reporting cannot be fast because it takes time to find and rewrite them in the required format. Even though making reports, reports, recapitulating equipment data that is always needed routinely for accreditation and other purposes, apart from that, laboratory users, both students, lecturers and others, have difficulty getting information about laboratory equipment data.

Therefore, a laboratory tool inventory system must be created whose results can be integrated into the tool database, tool catalog, and reporting. The information system must be accessible online based on the web in accordance with technological developments in the 5.0 era (Rahmawati et al., 2021). The purpose of this research is to improve laboratory management services optimally by implementing a Big Data system (Hu et al., 2014) as a development of a laboratory management system that was previously built based on online forms and library applications where users can still freely use the system either via smartphones, tablets, computers or laptops.

METHODOLOGY

This research uses research and development methods (Sugiyono, 2019), which are research methods used to produce certain products, and test the effectiveness of these products. To be able to produce certain products, research that is needs analysis is used and to test the effectiveness of these products so that they can function in the wider community (Arikunto, 2020).

In this study the product produced is a laboratory management information system. The product results will be tested at the Basic Physics Laboratory to see the effectiveness and efficiency of these products in improving laboratory services with questionnaires and interviews (Kuter & Yilmaz, 2001). The subjects in this study were 68 students consisting of 2019, 2020, and 2021 batch students who carried out practicum service activities using the Laboratory Big Data system in management services in the Basic Physics laboratory. The flow of this research can be seen in the Figure 1.

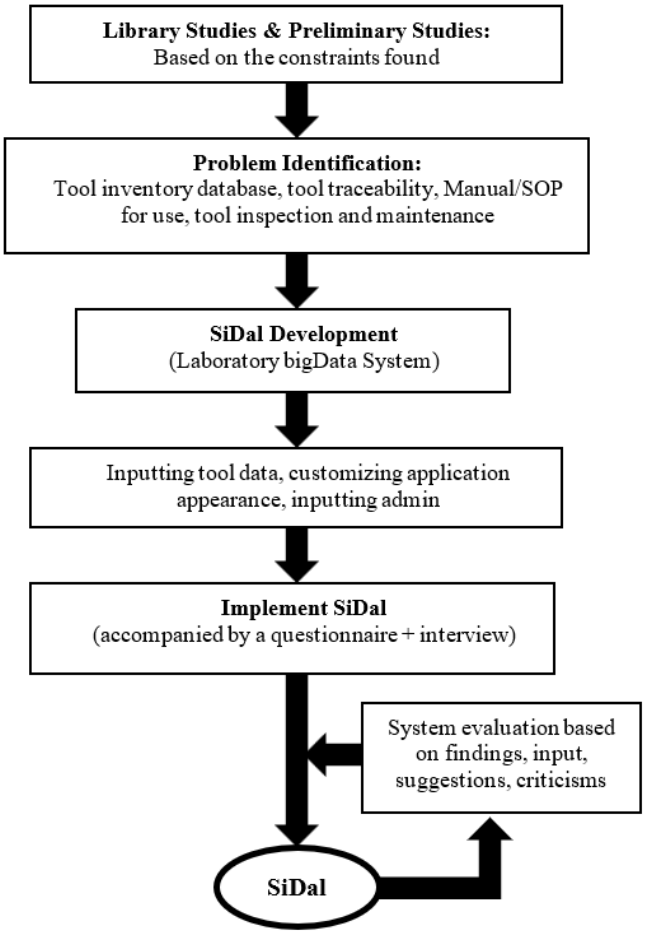


Figure 1. Research Flowchart

RESULTS AND DISCUSSION

Application Description

The inventory system implemented in the Basic Physics Laboratory is based on tool coding that has been assigned as tool ID. This is to make it easier to identify tools if there are tools that are

damaged, lost or borrowed. When there is a new tool, the coding follows the existing rules. Inventory of tools at LFD is carried out routinely every year, but because of the large number of tools while the lab manager is only 1 person, not all tools are successfully identified every year.

The tool arrangement system in the Basic Physics Laboratory is regulated based on (Figure 2):

1. Tool group: namely arrangement based on the type of material, for example glassware placed in the same cupboard. Electrical tools are also grouped in the same cupboard, making it easy to find tools.
2. Characteristics of the tool: the placement of the tool must also pay attention to the characteristics of the tool. Glassware must be stored in a cupboard that is easily accessible, spacious and safe for placing glassware. Flammable materials must be stored in a cupboard close to a faucet/water source. Heavy equipment is not stored on the upper rack, so that it is easy to pick up and avoid the risk of accidents. So, the arrangement based on the characteristics of this tool is very important for the safety of the tool and the user. For this reason, before being placed, tools and materials are identified first so that the arrangement and grouping are correct.
3. Intensity of use of tools: Tools that are often used for practicum and research are placed in a cupboard that is easy to access.

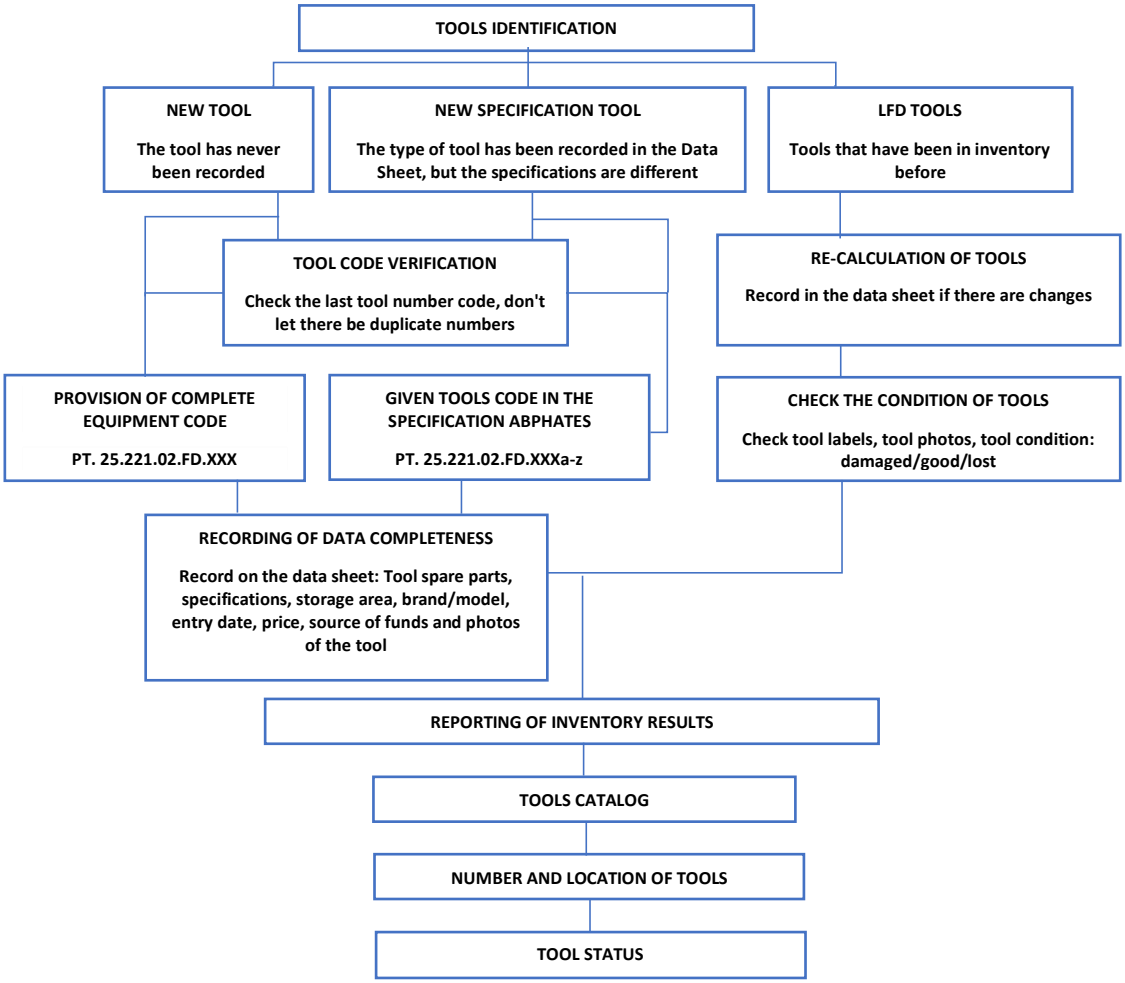


Figure 2. Tool inventory system flowchart images

Figure 2 illustrates the flow of the tool inventory system carried out in the Basic Physics laboratory, the results of the inventory input can be processed for tool catalogs, number and location of tools and tool status.

A web-based computerized inventory system (Sittig et al., 2010) for laboratory equipment is named SiDal (Laboratory Big Data System). It's also easy to recap, managers just need to export the desired data. Direct printing facilities are also available.

Flow Chart SiDAL System

Some of the authority admin/ user permissions shown in table 1.

Table 1. Authority admin/ user permissions

No	Authority	
1	Back-office :	User can access to the administration panel.
2	Manage-dal:	User can create, delete or modify the DAL.
3	Manage-user:	User can create, delete or modify the users.
4	Menu-permission:	User cand create, delete or modify the menu.
5	Role-permission:	User can edit and define permissions for a role.

Each admin can have more than 1 authority. The person in charge of the laboratory / lab manager is given full authority. For laboratory assistants who are assigned to inventory tools and materials, they are given 2 authorities, namely Back-office and manage-dal. SiDal users are students, lecturers and the general public who need information about the Basic Physics Laboratory. To make it easier for users, SiDal can be accessed on smartphones, tablets, PCs or laptops

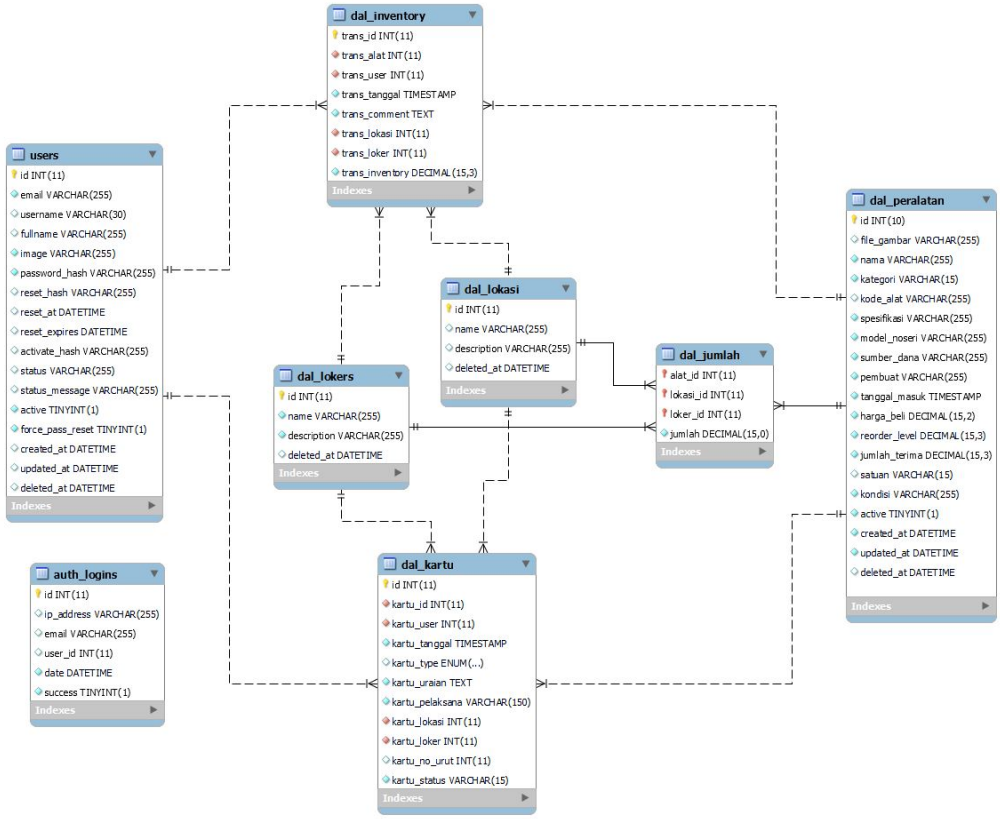


Figure 3. Data relationship flowchart in the SiDal application

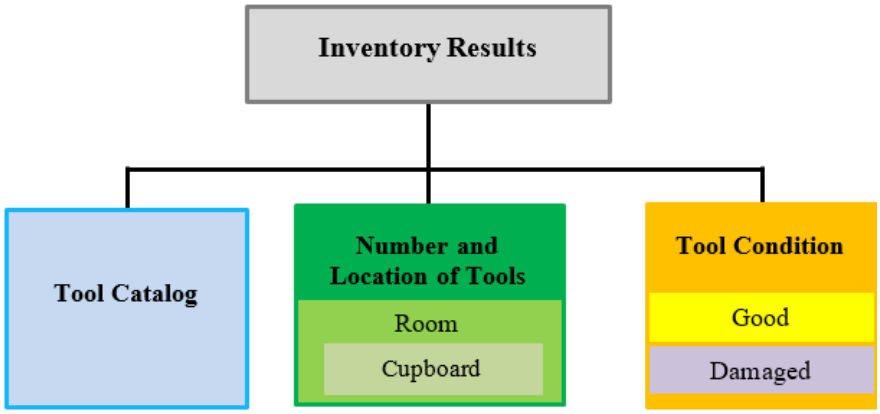


Figure 4. A simple overview of the SiDal application

Figure 3 is a diagram illustrating the data relations created in SiDal. The simple flow is explained in Figure 4, the relationship between the existing inventory system in SiDal. The Laboratory Manager (Martin, 1985) only needs to input the equipment inventory data, the result of which will be a tool database for data on the number and location of the tools, the status of the tools and later will lead to the tool catalog. For SiDal admins/managers, log in by first creating a personal account. In use, admin authority varies.

SiDAL Features

The SiDAL Features can be shown in figure 5.

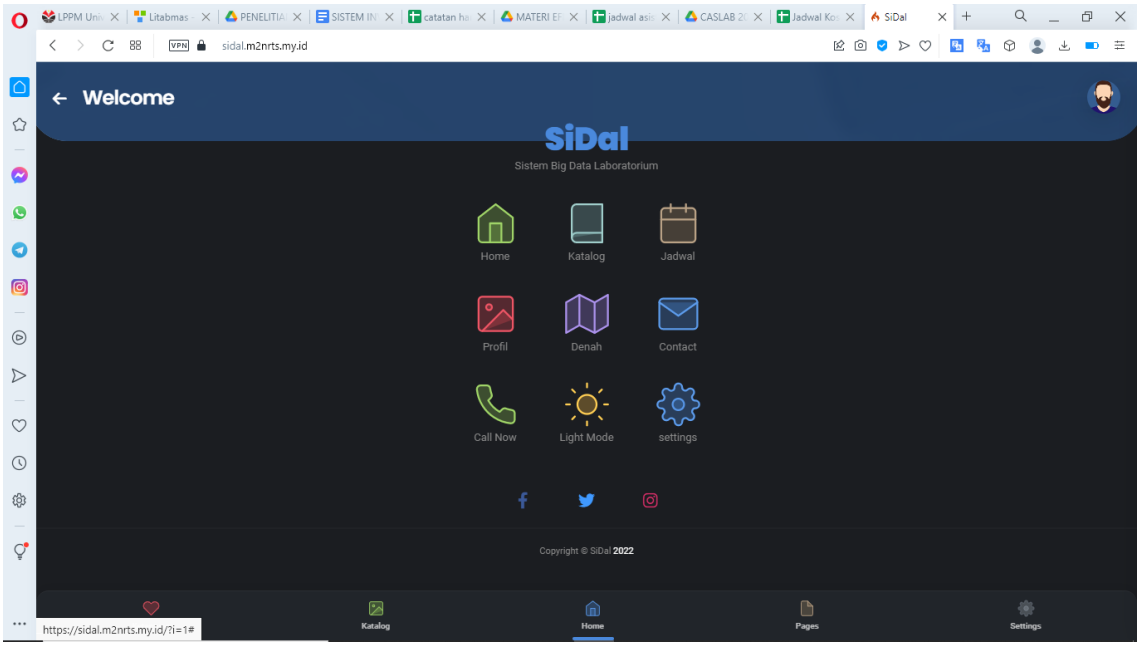
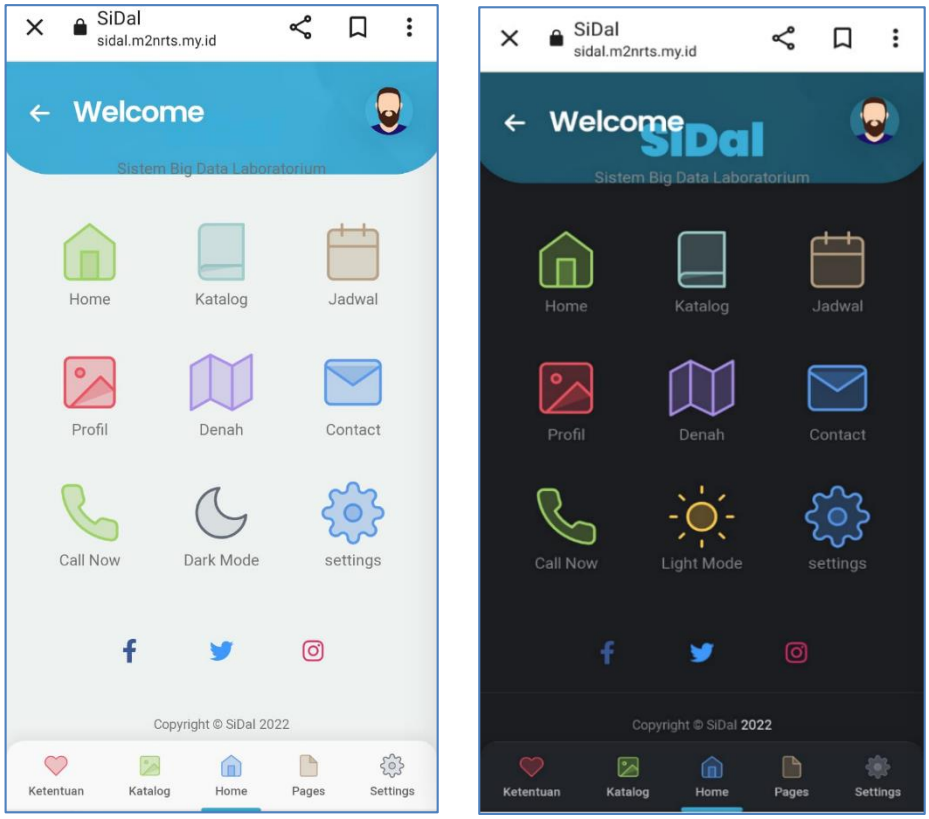


Figure 5. Display of SiDal on a laptop

On the SiDal display, as shown in Figure 5 above, there are several menu options, namely:

1. Home: is the initial display when the user opens SiDal, the appearance is as shown in the picture.
2. Catalog: Contains a catalog of tools and materials for the Basic Physics Laboratory
3. Schedule: Contains the laboratory use schedule
4. Profile: User's personal data

5. Floor Plan: Basic Physics Laboratory Floor Plan
6. Contact: Phone number for the admin/manager of the Basic Physics laboratory
7. Call Now: If the user wants to directly contact the admin / laboratory manager
8. Light Mode / Dark Mode: Choice of features for display whether to be dark or light (Eisfeld & Kristallovich, 2020)
9. Settings: Application settings according to personal wishes



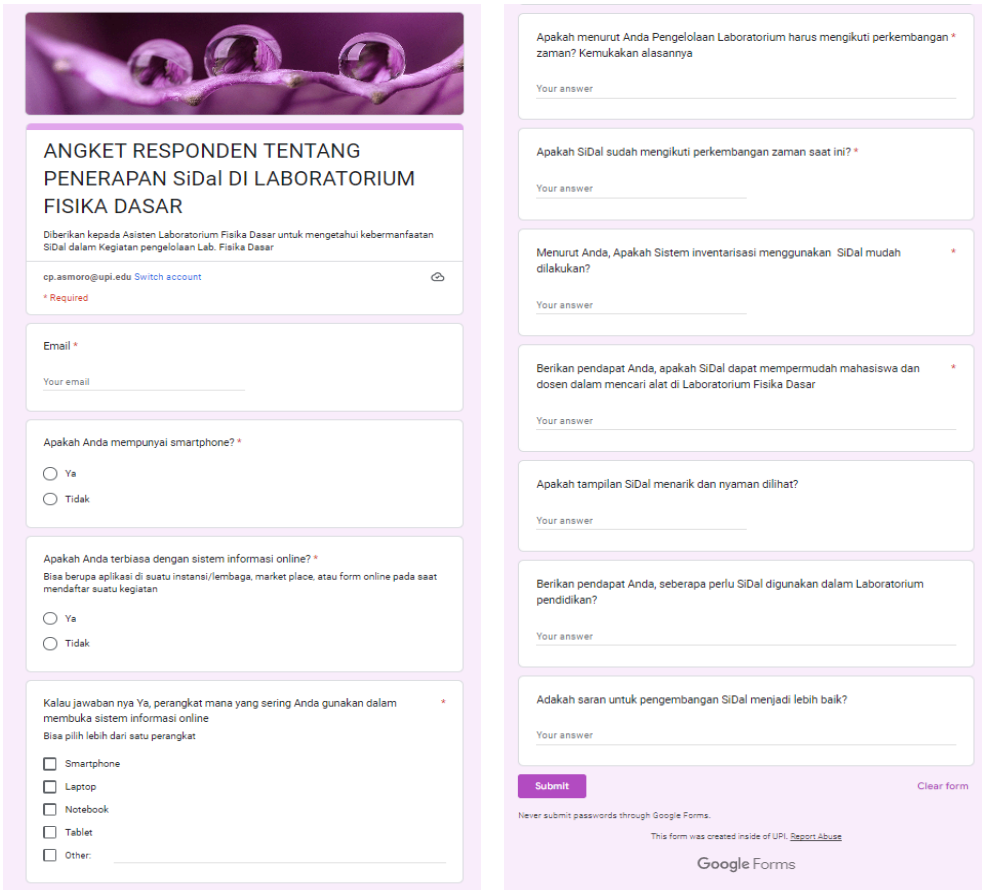
(a) (b)

Figure 6. SiDal display on a smartphone with light mode and dark mode displays

Figure 6 is the display of SiDal on a smartphone, making it easier for students/users to use the application. To pamper users who mostly students are Gen-Z (Seemiller & Grace, 2016), the display is given 2 choices in dark mode and light mode. Users can choose the appearance according to their respective tastes.

SiDAL User Questionnaire Results

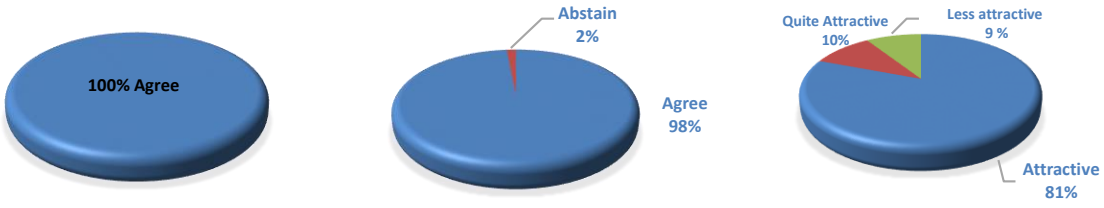
To find out how well the SiDAL system is acceptable, questionnaires and interviews were distributed with the target respondents regarding the use of SiDal, namely students in semester 3, semester 5 and semester 7 of the Department of Physics Education who have conducted practicum at the Basic Physics Laboratory (LFD). As many as 68 respondents were obtained who had used SiDal, using the form online (Sianipar, 2019) at the address https://bit.ly/angketSIDAL with the questions in Figure 7.



(a) (b)

Figure 7. SiDaL Questionnaire

From the results of the questionnaire, it is known that 100% of respondents use a smartphone and are used to using online information systems. Apart from using smartphones, the respondents are also used to using laptops, notebooks and tablets. All of them agree that the laboratory management system must keep up with the times. After the respondents tried using SiDaL, 100% of them agreed that what we had done to build SiDaL was in accordance with the times.



(a) Ease of Search (b) Ease of Inventory (c) Attractive Views

Figure 8. Diagram of the questionnaire results

In Figure 8, it will show how respondents give an assessment after using some of the main features of SiDaL. 100% gave answers agreeing with the search feature making it easy for users, there is an inventory feature that gives an idea of how many tools the laboratory has and the number of tools that can be borrowed because it provides information as well as tools that were

borrowed previously. When a more subjective statement related to the appearance of SiDaL shows a variety of responses, this is natural because it will be related to the tastes of the respondents, but in general around 81% stated that SiDal's appearance was already attractive.

CONCLUSION

The implementation of SiDal in the Basic Physics Laboratory as a whole received a good response from students as one of the users of the laboratory. The results of questionnaires and written interviews given to 68 students from semester 7, semester 5 and semester 3 showed a percentage of 98% agreed that the inventory system using SiDal was easy to implement. They are also happy with the existence of a catalog at SiDal which makes it easier for students to find the tools they need and to use them practically. Laboratory users only have to open the SiDal link on their smartphone, and type in the name of the tool they are looking for, details of the tool and specifications of the tool will appear along with a photo of the tool. We hope that SiDal can improve laboratory services, so that the learning process in the laboratory can be carried out optimally.

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