



Design of Innovative Kindergarten System on Mobile Technology

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ABSTRACT

Regular and paper-based study reporting distributions given to kindergarten students have disadvantages. The first is study reports are generally given every quarter or semester, so there is a long enough time span in the delivery of problems or information. The second is, if there is a problem of student development, no quick decision can be made. The third is paper-based study reports are easily damaged and difficult to trace. The fourth, intense communication in both directions between school and parent cannot be done well. In this paper, we introduced a mobile-based study reporting system that will eliminate all the problems above. Our research also based on the use of mobile devices (smartphones) that are widely used.

Key words: Minnesota Child Development Inventory Mobile Application, Web Application.

1. INTRODUCTION

The distribution of study reports has always been shared and has become a regular agenda at school. The reports are generally in the form of paper or books, which are distributed when parents come to school. The meeting schedule has been notified beforehand, with the expectation that all parents can attend. This method is not effective, because it requires a special time and limited discussion time. While much information needs to be conveyed by the school to parents.

The study report was created by the teachers after some time of evaluation. There is a possibility of missing information, due to the long period of time. While the development of children should be immediately addressed without having to wait for the evaluation process. Therefore, this paper-based report has several disadvantages:

- 1) Report creation is created manually and should think and consider about previous observations.
- 2) The making of the study report takes time, whereas the need for quick monitoring and control in responding to student progress. Because at an early age (golden period), the development of the child is very important to form the personality.
- 3) Conditions can be delayed, when quick action is

needed on the unachieved developments of the student.

- 4) The study report is one-way from school to parents, so it cannot be a two-way communication media.
- 5) The use of paper that tends to be easily damaged, lost and difficult to trace if necessary.

In this paper, we introduced a mobile-based study reporting system on smartphone or mobile devices. This system will be used by both the teachers and the parents. Information can be presented real-time with push notifications technology.

The advantages of using reporting system on smartphone are:

- 1) Parents can receive information on their child's development quickly and real-time.
- 2) Parents can act quickly on unachieved developments of their child.
- 3) Both teachers and parents can monitor each other's progress.
- 4) Make it easy to monitor developments after follow-up, as well as serve as a reminder.
- 5) Support intense two-way communication between school and students.
- 6) Can serve as a media for providing information on school activities in general.
- 7) It has the value-added of being a social media platform internally within the school and classroom environment.

However, this system can also be enhanced to produce printouts, which are generally required for enrollment at the next level of education. Our research also based on the use of mobile devices (smartphones) that are widely used.

2. LITERATURE REVIEW

With increased special education legislation, most recently PL 94-142, increased pressure has been placed on educators to provide screening programs to identify children likely to have trouble in mastering basic school tasks. Such pressures have been complicated by concurrent legislation in the health-screening area, with provisions for early and periodic screening, diagnosis, and treatment for physical and mental defects being made available to families from poverty or culturally disadvantaged backgrounds. Whereas there is little need to emphasize the importance of early diagnosis

and the associated implications for early intervention or remediation or both, there is much controversy over primary goals and means for carrying out such screening and intervention programs [1].

Standardized instrument using parents' observations to assess a child's development to six years of age. The MCIDI (Minnesota Child Development Inventory) consists of 320 true or false items grouped to form the following scales:

- 1) General Development (GD): an overall index of development consisting of the most age-discriminating items from all scales (131 items).
- 2) Gross Motor (GM): locomotion and related behaviors involving strength, balance, and coordination (34 items).
- 3) Fine Motor (FM): visual-motor skills ranging from simple eye-hand coordination to complex fine-motor behavior (74 items).
- 4) Expressive Language (EL): expressive communication ranging from simple gestures to complex oral expression (54 items).
- 5) Conceptual Comprehension (CC): simple comprehension of language and concepts (67 items).
- 6) Situation Comprehension (SC): nonverbal comprehension through observation, discrimination, imitation, and motor behavior (44 items).
- 7) Self-Help (SH): self-care skills including eating, toileting, dressing, and the like (36 items).
- 8) Personal-Social (PS): interactive personal and social behavior including initiative, independence, social interaction, and concern for others (34 items).

It is well known that teacher observations can be an effective means for identifying children having potential learning difficulty. However, the current study suggests that before a child starts school, parents may be able to provide information that is of considerable help in defining if a child will be at risk for reading difficulty in the primary grades. Information describing the child's general development and knowledge of letters and numbers was particularly helpful in screening the sample of children included in this study [2].

Every children who have potential multiple intelligence should be maximized by the presence of collaboration between teachers and parents. Gardner & Hatch (1989) defines eight intelligence are:

- 1) Logical Mathematical Intelligence, consists of the ability to detect patterns, reason deductively and think logically. This intelligence is most often associated with scientific and mathematical thinking.
- 2) Linguistic Intelligence, involves having a mastery of language. This intelligence includes the ability to effectively manipulate language to express oneself rhetorically or poetically. It also allows one to use language to remember information.
- 3) Spatial Intelligence, gives one the ability to manipulate and create mental images to solve problems. This intelligence is not limited to visual domains. Gardner notes that spatial intelligence is also formed in blind children.
- 4) Musical Intelligence, encompasses the capability to recognize and compose musical pitches, tones, and rhythms. Auditory functions are required for a person to develop this intelligence in relation to pitch and tone, but it is not needed for the knowledge of rhythm.
- 5) Bodily Kinesthetic Intelligence, is the ability to use one's mental abilities to coordinate one's own bodily

movements. This intelligence challenges the popular belief that mental and physical activity are unrelated.

- 6) The Personal Intelligences, includes interpersonal feelings and intentions of others and intrapersonal intelligence, the ability to understand one's own feelings and motivations. These two intelligences are separate from each other. Nevertheless, because of their close association in most cultures, they are often linked together.
- 7) Naturalist intelligence designates the human ability to discriminate among living things (plants, animals) as well as sensitivity to other features of the natural world (clouds, rock configurations).

Communication between home and school, which was initially of interest for understanding the child's transition into the school setting, could also be through of as reflecting a step in the empowerment process; the willingness to interact on behalf of the child with institutions somewhat distant ecologically from the family [3].

School and families' interaction need to fit the age, grade level and level of social and cognitive development of the children. Schools are more like families for young students, with closer ties between teachers and parents of preschool and early elementary students. Schools may become increasingly impersonal in the secondary grades, with the aim of preparing students for interactions in adulthood with other formal organizations in government, in work, in society [3].

There is sample evidence to support the contention that child-mother and child-teacher relationships play key roles in the development and maintenance of interpersonal, self-regulatory, and task-oriented competencies that support a broad spectrum of adjustment in early childhood settings, including classrooms. Available evidence suggests that this effect is more pronounced in high-risk samples. However, there have been few studies that include measures of both child-mother and child-teacher relationships in the prediction of school adjustment. The present study is designed to assess the unique contribution of teacher-child and parent child relationships to the prediction of early childhood school outcomes in a high-risk sample. Specifically, ratings of observed affect and control in mother-child dyads in preschool were examined in relation to preschool teacher-reported aspects of child-teacher security, conflict, and dependency. In turn, these relationship measures were used to predict children's performance and progress on language outcomes in preschool and to predict teacher-reported adjustment in kindergarten [4].

According to [5], they considered parental involvement as an outcome of parent, teacher and child influences. They also suggested that certain teacher and school characteristics might be related to school responses to parent involvement. They included the beliefs about the appropriate amount and type of parent involvement [5]. According to [6], employed 'parents' construction of their personal role to explain why parents chose to become involved in children's education. Expectancy theory also highlights the importance of role perception in explaining behavior. It is thus proposed that teacher's self-expectation in parent involvement, termed here self-expectancy, should be included in our model to predict teacher intention and behavior [6]. Further exploration of the literature followed up by interview

findings suggested that this self-expectancy might include teacher commitment [7], teacher accountability to parents [8], and teacher sense of shared responsibilities with parents [9].

Teacher sense of shared responsibility with parents refers to the extent to which a teacher believes that teachers and parents should work together and support each other for children's education. A teacher who holds a stronger sense of 'shared responsibility' is likely to communicate more frequently with parents. There exists a cultural dimension in human behavior [10] and parent involvement in school education [11][12][13].

Regarding the school information system, the research has been done by [14] in building web-based application of online report card and SMS gateway. This research uses field research techniques by conducting interviews in the field of academic and teachers in SMK PGRI Grafika Pakis Malang. The result of this research is report card of online information system gives ease in academic area, especially teacher in processing value [14]. In addition, students/parents can obtain information about academic online either through the internet or mobile phones and to produce more accurate information.

Subsequent research has been done by [15] by developing a web-based and mobile-based online school news card information system. This information system is an information system that can provide information services with the form of academic data so that students can access them through the web and mobile. The research method used in this research is based on field research method, with development system using waterfall model. The results of this study and the development of an online school report card information system is to facilitate the school as well as the teachers on the processing and storage of student academic data, teacher data, student class data and processing of student scores, and provide benefits for the school by providing information for student and parent about student academic [15].

With this web-based and mobile-based online report card system, teachers can further improve the efficiency of time in processing student grades, and students and parents can see the score of their learning results more easily. This web-based and mobile web-based reporting system has been well received by users, but there are still results indicating that the user satisfaction level is poor on some indicators, such as on credibility, coverage, navigation, objectivity, accuracy and timeliness indicators [16].

3. RESULTS

The proposed system architecture is multi-tier architecture. This architecture involves architecture for mobile application and web application. Kindergarten Reporting System will consist of 2 applications:

- 1) Mobile Application. Mobile application will be built using Xamarin and SQLite as the database storage. This mobile application is capable to run on Android, iOS, and Windows operating system.
- 2) Web Application. Web application will be built using ASP.NET MVC 5 (C#) technology and Microsoft SQL Server database. For the frontend user interface will be using Bootstrap with the responsive design, and have great compatibility with the mobile browsers.

The development of the system is also considered for future development and enhancement. Web application will be hosted in the cloud server, such as Microsoft Azure, Amazon Elastic Compute Cloud [17]. In mobile application there are 2 components installed, such as application and database. The database is a unity that cannot be separated with the application. This mobile application will be installed on the smartphone and used for simple data entry and view report. To use this application does not need to always connect to the internet, thus connection is only required when synchronizing data. The development technology used is Xamarin and SQLite for the database. With a C#-shared codebase, developers can use Xamarin tools to write native Android, iOS, and Windows applications with native user interfaces and share code across multiple platforms. Xamarin integrates with Visual Studio, Microsoft's IDE for the .NET Framework, extending Visual Studio for Android and iOS development. Xamarin also released a component store to integrate backend systems, third party libraries, cloud services and UI controls directly into mobile applications [18]. SQLite is an in-process library that implements a self-contained, server less, zero-configuration, transactional SQL database engine. The code for SQLite is in the public domain and is thus free for use for any purpose, commercial or private. SQLite is an embedded SQL database engine. Unlike most other SQL databases, SQLite does not have a separate server process. SQLite reads and writes directly to ordinary disk files. A complete SQL database with multiple tables, indices, triggers, and views, is contained in a single disk file. The database file format is cross-platform. These features make SQLite a popular choice as an Application File Format [19]. The web application consists of an application server and a database server. By using cloud system, then school does not need to make large investments in servers. Data exchange or sync process will be done through internet connection. The web application is used to manage all information, such as teachers, students, classes, courses, and scores. There are several functions that can only be done through a web application. The web technology used is ASP.NET MVC with Bootstrap as the user interface framework. This web application can be accessed using major internet browsers, such as Mozilla Firefox, Google Chrome, etc. This web application can be accessed anytime and anywhere, as it will be hosted on cloud services. The ASP.NET MVC is a web application framework developed by Microsoft, which implements the model-view-controller (MVC) pattern. ASP.NET MVC allows software developers to build a web application as a composition of three roles: Model, View and Controller. The MVC model defines web applications with 3 logic layers: model (business layer), view (display layer), controller (input control). A model represents the state of an aspect of the application. A controller handles interactions and updates the model to reflect a change in state of the application, and then passes information to the view. A view accepts necessary information from the controller and renders a user interface to display that information. The ASP.NET MVC framework couples the models, views, and controllers using interface-based contracts, thereby allowing each component to be tested independently [20]. Bootstrap is a free and open-

source front-end web framework for designing websites and web applications. It contains HTML and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Unlike many web frameworks, it concerns itself with front-end development only [21]. Microsoft Azure is a cloud computing service created by Microsoft for building, testing, deploying, and managing applications and services through a global network of Microsoft-managed data centers. It provides software as a service (SaaS), platform as a service and infrastructure as a service and supports many different programming languages, tools and frameworks, including both Microsoft-specific and third-party software and systems [22]. Regarding the data exchange between the mobile application and the web application, then there are protocols and data formats that will be used as a standard. For this purpose, we use REST protocol and JSON data format. Representational state transfer (REST) or RESTful web services is a way of providing interoperability between computer systems on the Internet. REST-compliant Web services allow requesting systems to access and manipulate textual representations of Web resources using a uniform and predefined set of stateless operations. In a RESTful Web service, requests made to a resource's URI will elicit a response that may be in XML, HTML, JSON or some other defined format. By using a stateless protocol and standard operations, REST systems aim for fast performance, reliability, and the ability to grow, by re-using components that can be managed and updated without affecting the system even while it is running [23]. In computing, JavaScript Object Notation or JSON is an open-standard file format that uses human-readable text to transmit data objects consisting of attribute-value pairs and array data types (or any other serializable value). It is a very common data format used for asynchronous browser-server communication, including as a replacement for XML in some AJAX-style systems. JSON is a language-independent data format. It was derived from JavaScript [24]. The system considers several aspects of security. This aspect is important because it concerns the data owned by the school. Here are some security concerns:

- 1) To support the security of the system, both mobile application and web application will be authenticated and authorized.
- 2) The process of synchronizing data to the server using an encrypted protocol (HTTPS).
- 3) Data storage on mobile applications also uses secure storage.
- 4) There is an audit trail function to record every transaction activity performed.

Here is the use case diagram of this system

Based on the analysis, we determine the requirements that must exist in the system:

- 1) Administrators after login to the system can manage teacher data, manage student data, manage courses, manage classes, manage financial status and see the progress reports of students.
- 2) Principals after login can view student information, view class activity, view financial report and manage discussion forums.

- 3) Teachers after login can input student data, input scores, input progress of the students, input class activities, and manage discussion forums.
- 4) Parents after login can view the progress reports of their children, view student score, view class activity, view financial status, interact in the discussion forum, and can view the studying reports.

The following functional requirements of the system are described in the figure 1 for use case admin management:

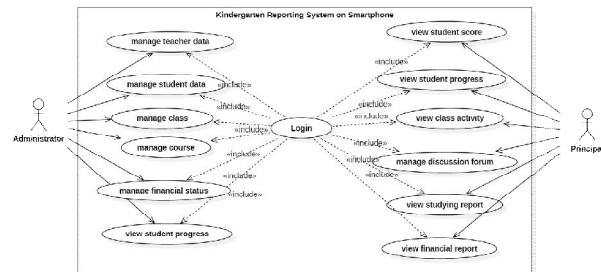


Figure 1: Use Case Admin Management

Then, figure 2 shows the use case diagram teacher management

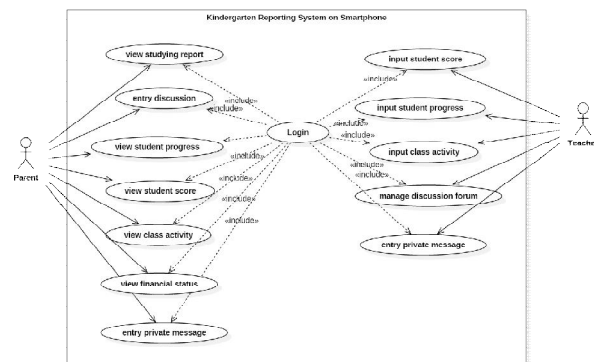


Figure 2 : Use Case Teacher Management

Here is the entity relationship diagram of this system. Figure 3 shows the ERD below:

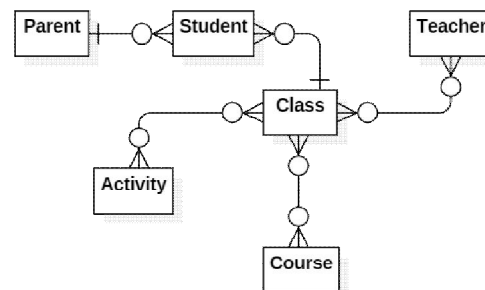


Figure 3 : Entity Relationship Diagram

Here we design a system that consists of 2 applications, mobile application and web application. Mobile application can run on Android, as well as iOS.. Figure 4 shows the system architecture :

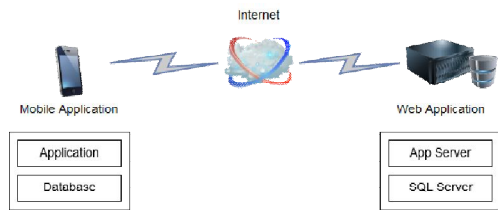


Figure 4 : System Architecture

Here are the features available on mobile application:

- 1) General functionalities
 - a. User authentication and authorization
 - b. Data synchronization to server (web application)
 - c.
- 2) Functionalities for parents
 - a. View studying report
 - b. View student progress
 - c. View student score
 - d. View class activity
 - e. View financial status
 - f. Entry discussion
 - g. Entry private message

Figure 5 shows the screen that is displayed when the users open the application for the first time.

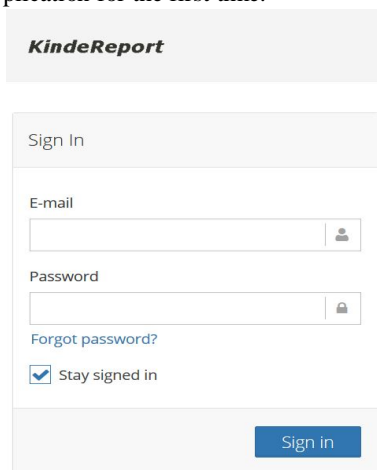


Figure 5 : System Architecture

Figure 6 shows the users must login by filling in the username and password that have been registered before. After that will be shown the main page and the menus that can be accessed.

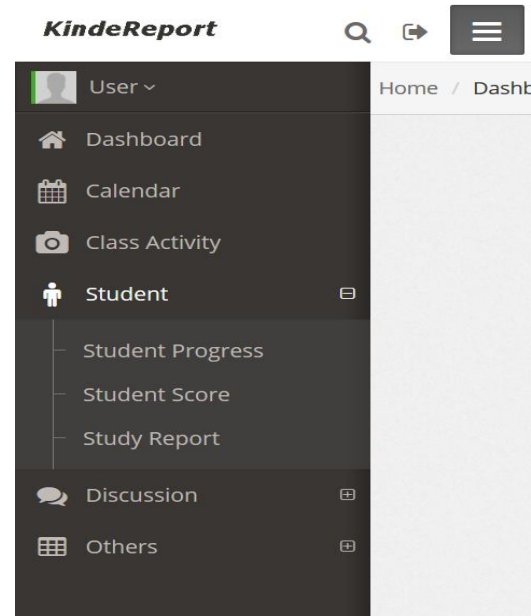


Figure 6 : Main Menu

This main page contains a dashboard containing the progress of the child up to the present time. The information displayed is the main information that will be of primary concern. The information is:

- 1) Faith
- 2) Affection
- 3) Language
- 4) Cognition
- 5) Social
- 6) Physical
- 7) Esthetic

This information is presented as a pie chart which each aspect has its own value. This makes it easy for parents to instantly see the progress of every aspect. Figure 7 shows the dashboard information report :

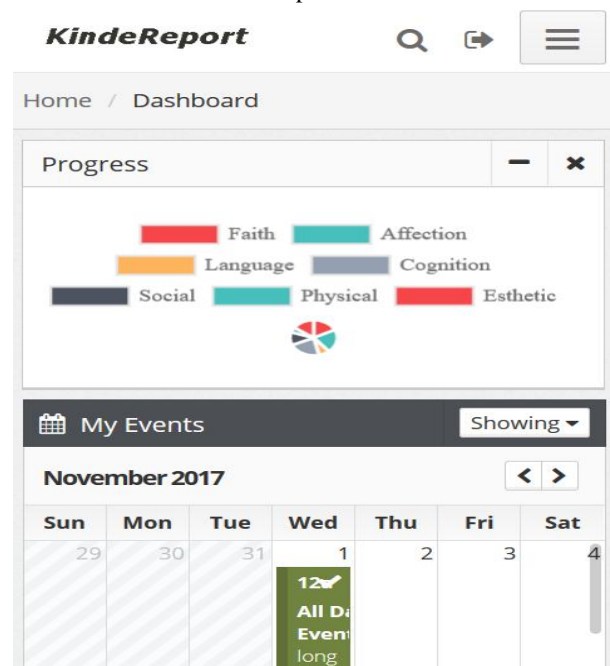


Figure 7 : Dashboard Information

By looking at the dashboard, the parent can immediately act or discuss with the teacher on how to educate and the steps that need to be taken to help the child's development. Every child development can also be seen historical development. Thus, parents can monitor the development of children every day. On the main page is also available information about the agenda of school activities. This is to make it easier for parents to monitor the activities that will be done in the future. To discuss with the teacher, parents can directly select the discussion menu. Discussion forums are used to discuss the subject matter and all related activities. Parents can directly discuss with the school or with other parents. Any child development can be discussed here, including how to handle it at home.

This discussion forum will be very useful because it allows two-way communications between the school and the parents. Related to it, the figure 8 shows the discussion forum that consists of several menus that can be chosen .

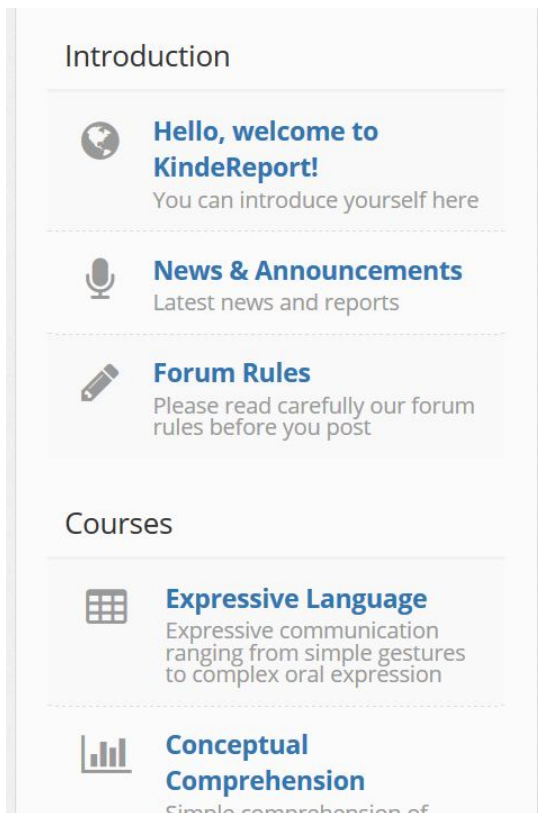


Figure 8 :Discussion Forum

Every activity in the school can also be seen by viewing the timeline story or photo uploaded by the teachers. This feature is like social media in general, where parents can comment on timeline story or photo displayed. Figure 9 shows the detail of activity

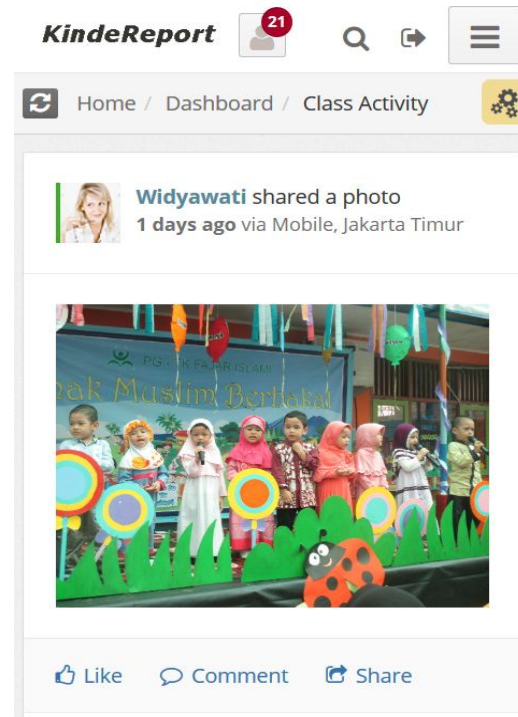


Figure 9 : Activity

At the end of the semester parents can immediately see the final value of the child's development. For the future purpose, this system can also be enhanced to produce printouts, which are generally required for enrollment at the next level of education. Figure 10 shows the kindergarten progress report.

LAPORAN PERKEMBANGAN ANAK

NO	Kelompok :	PERKEMBANGAN ANAK	Tahun Pelajaran :							
			Semester 1				Semester 2			
			BB	MB	BSH	BSB	BB	MB	BSH	BSB
I.		A FEKSI								
		A. Trust (Rasa Percaya)								
		1. Berpisah dengan pendamping								
		2. Merasa nyaman di sekolah								
		3. Membuat orang lain merasa nyaman di sekolah								
		4. Percaya dengan teman								
		5. Percaya dengan guru								
		6. Bergantian dengan teman dalam menggunakan suatu benda								
		B. Autonomy (Kemandirian)								
		7. Melakukan kegiatan sendiri								
		Makan								
		Merapikan tas								
		Membersihkan diri sendiri (cuci tangan/kaki, menyikat gigi)								
		8. Merasa sanggup melakukan sesuatu dengan kemampuan sendiri								
		C. Inisiatif (Arahan Diri)								
		9. Melakukan kewajiban tanpa diingatkan								
		10. Mencetuskan ide dan berani mengungkapkannya								
		D. Industry (Kerja Keras, Tekun, Rajin, Daya Juang)								
		11. Fokus melakukan kegiatan								
		12. Melakukan kegiatan dengan tuntas								
		13. Sabar menunggu giliran								
		14. Sabar dan mampu melakukan kegiatan dengan proses								
		15. Menjalani pekerjaan baru yang penuh tantangan								
		16. Pantang menyerah walau menemukan kesulitan								

Figure 10 : Kindergarten Progress Report

The web application is used to manage all information, such as teachers, students, classes, courses, and scores. There are several functions that can only be done through a web application. This web application is primarily accessed by teachers and school managers to be able to manage the data and content. Here are the features available on web application:

- 1) General functionalities
 - a. User authentication and authorization
- 2) Functionalities for administrators
 - a. Manage teacher data
 - b. Manage student data
 - c. Manage class
 - d. Manage course
 - e. Manage financial status
 - f. View student progress
- 3) Functionalities for principals
 - a. View student progress
 - b. View student score
 - c. View studying report
 - d. View class activity
 - e. Manage discussion forum
 - f. View financial report
- 4) Functionalities for teachers
 - a. Input student progress
 - b. Input student score
 - c. Input class activity
 - d. Manage discussion forum
 - e. Entry private message

Here is the screen that is displayed when the users open the web application for the first time, that can be shown in figure 11

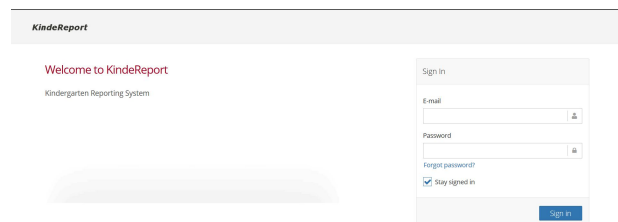


Figure 11 : Main Screen

Users must login by filling in the username and password that have been registered before. After that will be shown the main page and the menus that can be accessed.

There is several information that can be managed by the users. That information is:

- 1) Teacher information
- 2) Student information
- 3) Course information
- 4) Class information
- 5) Financial management
- 6) Discussion forum

Figure 12 below shows the features of teacher information

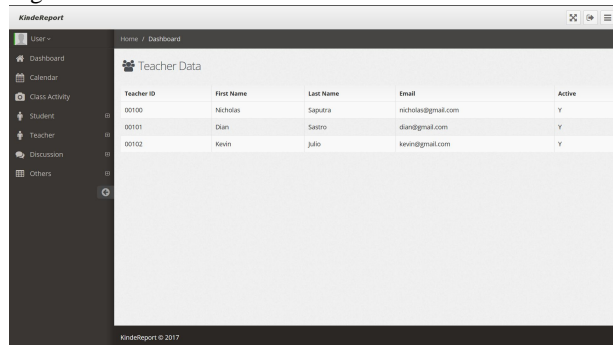


Figure 12: Teacher Information

Figure 13 below shows the features of course information

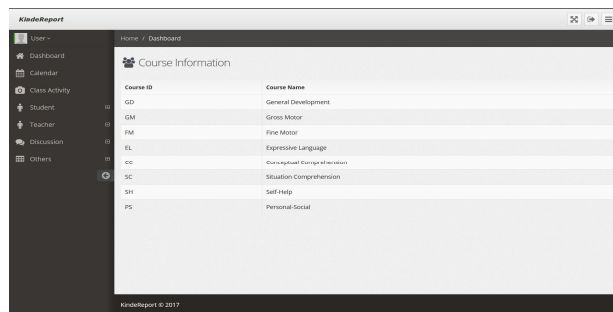


Figure 13 : Course Information

4. CONCLUSION

Regular and paper-based study reporting distributions given to kindergarten students have disadvantages. In this paper, we introduced a mobile-based study reporting system on smartphone or mobile devices. This system will be used by both the teachers and the parents. This system is designed specifically for kindergarten because it aims to deliver information quickly. Information can be presented real-time with push notifications technology. Thus, monitoring the development of children, especially in this golden period can be done well.

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