Data infrastructure and information design of e-learning in primary school

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Abstract. The Industrial Revolution 4.0 presents technologies that make it easier for humans to help their daily activities, one of them is exchange of information through the internet. Information accessed using internet makes easy because can be accessed anytime, anywhere, and there are no limited on the device used. The software that is often used to access this information is a browser which is a website-based tool. It can also be used as a learning media by academics and students are called electronic learning or e-learning. Academics and students can easily get the information they need. Information on e-learning creates new sources of wealth. However, large data have problems is information overload that results in information that is related or not related to needs. Therefore, it is necessary to call information according to either the provider or recipient of information in an e-learning container stored in a database based on the information content using the Data Manipulation Language (DML) in the Structure Query Language (SQL). This research boundary to the database design for the development of e-learning for elementary school environments, starting from analysis, designing relationships between data using Entity Relationship Diagrams (ERD), Context Diagrams and Data Flow Diagram (DFD).

1. Introduction

The Industrial Revolution 4.0 has a positive impact, especially in facilitating human activities. In a pandemic, technology is urgently needed to remain productive and pay attention to the Covid-19 protocol by conducting social distancing. In field education field, teaching and learning activities must continuous and even have to keep going. One form of using technology in the field of education is to use digital learning or also known as e-learning. The learning process using e-learning according to Fatmawati et al. [1] can optimize technological progress easily without being limited by protocol matters. In addition, students can understand the material indefinitely. According to Arifin and Herman [2], the learning independence of students who get the e-learning web centric course model is better than students whose learn using power point media. According to Elyas [3], learning model is a new breakthrough in the field of teaching and learning because it is able to minimize differences in teaching methods and materials and provide more consistent quality standards for education.

The use of scattered information through digital media allows an increase in the amount of data that is getting bigger and allows displaying information that irrelevant with topic needed [4,5]. This irrelevant information problem is called information overload [6]. Therefore, this article limits e-learning to primary school.
This article aims to create a data infrastructure and e-learning information design in primary schools that can reduce redundant information. The arrangement on this certificate contains section introduction of an introduction to an overview of e-learning, section related works on work related to e-learning, section system design on the e-learning prototype application, section the experimental results about data and section conclusions and future work.

2. Related works
Research Fatmawati et al. [1] "Aplikasi E-Learning Sekolah Dasar (Sd) Muhammadiyah 2 Kauman Surakarta Untuk Menambah Interaksi Guru Dan Siswa" made an e-learning application using Diagram Context, Data Flow Diagram (DFD), Entity Relation Diagram (ERD) design and produced e-learning applications that were useful for supporting learning activities. teaching at SD Muhammadiyah 2 Kauman with the aim of increasing interaction between teachers and students so as to promote student centered learning.

The research was conducted on junior high school education by Wibawa and Edah [7] with the title "Aplikasi E-Learning di SMP Negeri 46 Bandung". Development and application approaches using a prototype model and using system design tools Flow maps, Context Diagrams, Data Flow Diagram (DFD), Entity Relation Diagram (ERD) as well as relationship and implementation tables. Programming language using PHP and MySQL as a database. The purpose of this research is to add a means to obtain material by downloading, flexible learning, and can explore students in using the internet.

Research Tegal and BSI [8] "Perancangan E-Learning Berbasis Web Pada SMP Negeri 3 Patuk Gunungkidul Yogyakarta" in his research designed a web based e-learning application using the waterfall method as a means of supporting the teaching and learning process between teachers and students. This research produces e-learning that can be accessed outside of class hours so as to increase the intensity of communication between teachers and students.

Research in addition to the education area was also carried out by Suhendro and Aprilila [9] a study "Perancangan dan Implementasi Reaslisasi Anggaran Pendapatan (Studi Kasus: Pengadilan Negeri Klas IB Pamatangsiantar)" using Data Flow Diagram (DFD), Entity Relation Diagram (ERD) and Normalization design models with the aim of producing efficient and more accurate data reports.

3. System design
System design is prototype for build an application e-learning, in this paper focused on analysis and infrastructure data show in figure 1.

![Figure 1. System design e-learning in primary school.](image)

Analysis and infrastructure data breakdown are requirement analytics, diagram context, data flow diagram, and activity diagram.

3.1. Requirement analytics

3.1.1. User analytics. User analytic is user can be access information e-learning, there are three users type task on infrastructure data e-learning show on table 1.
Table 1. User analytics.

| No | User      | Description                                                                 |
|----|-----------|-----------------------------------------------------------------------------|
| 1  | Guests    | View material (Infographics, Documents and URL).                             |
| 2  | Contributors | User registered as contributors can access and upload material (Infographics, Documents and URL). |
| 3  | Admin     | Administrator application e-learning control class, subject, contributors and material. |

3.1.2. **Software analytics.** Software requirements are conditions or capabilities that must be possessed by software to fulfil desired user. In this article the software requirements needed by the e-learning information system include:

- Login page as security system.
- Three types of material is infographics, document, and uniform resource locator (URL) address.
- Administrator user define class and sub material.
- Contributors upload material based on class and sub material.
- Information material accessed by guest and fill review each material.

3.2. **Diagram context**

Overview of data infrastructure and information design called diagram context is relationship between users. Guests is external entity otherwise admin and contributors as internal entity. Guest request material on website and material can be download after write a review. Admin and contributor special are can access backend page on website. Admin define class (class 1 until class 6) and their sub material example class 1, sub material “Tema 1 - diriku”, “Tema 1 - Tubuhku”, “Tema 1 - Aku Merawat Tubuhku”, etc. Besides that, admin can control user management contributors as insert, update and delete user. User contributors can registered fill the form and upload material as infographic, document and URL address. Diagram context infrastructure and information design can be show in figure 2.

![Diagram context](image)

**Figure 2.** Diagram context.

3.3. **Data Flow Diagram (DFD)**

Data flow diagram describe relationship internal user and detail process from diagram context. Based on section 3.1. diagram context internal user is admin and contributors show on figure 3.
Data Flow Diagram infrastructure and information design are two process registration process and upload material process. Process 1.0 registration form attribute contributors as name, email, password to login backend homepage. After user contributors registered user, contributor can upload material based on class and sub theme as class, sub theme, description and type of material. Type of material are infographics, documents and URL address. Admin can view user contributors and material upload contributors.

3.4. Activity diagram
Activity diagram describe activity user on data infrastructure and information design. Activity diagram show on figure 4.
4. **Experiment results**

In this section result on system design describe model data and view material using Structure Query Language (SQL).

4.1. **Entity relation diagram**

Entity Relationship Diagram is a diagram used to model the relational database in section tree of the system design. Database Management System (DBMS) is data storage place (table) and the relationships between these tables which are arranged according to certain rules. ERD in e-learning is shown in Figure 5.

![Entity relation diagram](image)

**Figure 5.** Entity relation diagram.

The relationship between admin entities and contributors is shown in material relations, while the relationship with guest is access. The data types used in each are shown in the following tables 2-4:

| Table 2. Entity admin. |
|-----------------------|
| tbl_admin             |
| No. | Field | Type Data (Length) | Description |
|-----|-------|-------------------|-------------|
| 1   | user_id   | int (5)         | Increment id |
| 2   | name       | varchar(20)     | Username Admin |
| 3   | password   | varchar(15)     | Password Admin  |
| 4   | email      | varchar(20)     | Email Admin |

| Table 3. Entity contributors. |
|-----------------------------|
| tbl_contributor             |
| No. | Field | Type Data (Length) | Description |
|-----|-------|-------------------|-------------|
| 1   | user_id   | int (5)         | Increment id |
| 2   | name       | varchar(10)     | Username Contributors |
| 3   | password   | varchar(20)     | Password Contributors |
| 4   | email      | varchar(20)     | Email Contributors |

| Table 4. Entity material. |
|--------------------------|
| tbl_material             |
| No. | Field    | Type Data (Length) | Description |
|-----|----------|-------------------|-------------|
| 1   | user_id  | int (5)          | Increment id (contributors) |
| 2   | class    | varchar(15)     | Name of class (admin) |
| 3   | submaterial | varchar(20) | Sub Material class (admin) |
| 4   | title    | varchar(20)     | Title of material (contributors) |
| 5   | description | text       | Description of material (contributors) |
| 6   | review    | text            | Review form guest |
4.2. **Structure Query Language (SQL)**

Structure Query Language (SQL) is a command to access database e-learning. SQL has three kinds to access: Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL). Data Definition Language is used to create databases, create entity tables such as admin, contributor, and material. Data Manipulation Language is used to manipulate data such as view data material for guests, edit data material for contributors, and delete material for contributors. Meanwhile, the function of Data control language is to separate privilege access to users.

4.2.1. **Data Definition Language (DDL)**. Entity diagram execution by DDL creates tables admin, contributors, and material. Syntax to create a table is shown in Table 5.

| Table 5. Data Definition Language (DDL). |
|------------------------------------------|
| **Format DDL** | **Example** |
| 1. CREATE TABLE table_name ( | 1. CREATE TABLE tbl_admin( |
| 2. column1 datatype, | 2. user_id int(5), |
| 3. column2 datatype, | 3. name varchar(20), |
| 4. column3 datatype, | 4. password varchar(15), |
| 5. .... | 5. email varchar(20), |
| 6. ); | 6. PRIMARY KEY(user_id) |
| 7. ); |

4.2.2. **Data Manipulation Language (DML)**. Data material execution by DML selects data material database on class and sub-material. Syntax to select data based on class 1 create table shown in Table 6.

| Table 6. Data Manipulation Language (DML). |
|------------------------------------------|
| **Format DML** | **Example** |
| SELECT * FROM table_name WHERE field = 'find'; | SELECT user_id, class, submaterial FROM tbl_material WHERE class = 'Kelas - 1'; |

Result on syntax DML shown in Table 7.

| Table 7. Result DML entity material. |
|--------------------------------------|
| No. | user_id | class | submaterial |
|-----|---------|-------|-------------|
| 1   | 1       | Kelas 1 | Diriku     |
| 2   | 1       | Kelas 1 | Tubuhku    |
| 3   | 1       | Kelas 1 | Aku Merawat Tubuhku |

5. **Conclusion and future work**

The data infrastructure design stage is the first step in the development of e-learning applications. Architecture in data modeling used to conceptual data uses a Diagram Context approach and Data Flow Diagrams are used to breakdown context diagrams. The type of database used in e-learning uses Structure Query Language (SQL) and uses Data Definition Language (DDL) command as a definition of entities, Data Manipulation Language (DML) is used to search for material so that searches made by guests are relevant.

After the database is formed, the future work is to develop applications using the PHP programming language. Selection of the appropriate PHP programming base based on the related work section because the programming language is suitable for the use of the MySQL database model.

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