Developing of EDGIV web application to support voluntary teaching program

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Abstract. The problem of equitable access to quality education in Indonesia is increase seen during the Covid-19. Mataharikecil, as one of the social foundations, is trying to take apart. But based on our observation, not all volunteers know how to teach the students. It can cause the education quality provided does not meet the qualifications set by the government. The purpose of this research is to provide a digital platform that can help volunteer teachers in the learning process, starting from preparation, implementation, to evaluation of the learning process. The platform developed is a web-based application called EDGIV. EDGIV is built using the Framework for Application of System Thinking (FAST) method with the stages consisting of Scope Definition, Problem Analysis, Requirements Analysis, Logic Design, Decision Analysis, Physical Design and Integration, Construction, and Testing. Installation and Delivery. EDGIV provides learning materials features based on the curriculum set by the government, course tracking, and the administration feature. EDGIV uses web technology so volunteer teachers can access EDGIV from any device, anytime, and anywhere. It is hoped that EDGIV can provide guidance for volunteer teachers in providing standardized teaching and make the learning experience enjoyable for teachers and students.

1. Introduction
Equitable is an opportunity to obtain quality education is the right of every citizen in order to develop their abilities and potentials to achieve the country's goals that are to educate the nation's life according to the function of National Education as stated in the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System [1]. However, in reality, there are still problems with equal distribution of education, especially those experienced by the average citizen from the poor students, such as access to quality education, and its impact was felt during the Covid-19 pandemic conditions [2]. The problem of equitable education in Indonesia is caused by inequality in the economic level of the people, differences in educational facilities in regions, inequality in the distribution of schools, high standards of school entry with grades, and clustering [3].

Nowadays, many foundations and social communities have been established in the field of education. As a form of public awareness, such as Indonesia Mengajar, 1000guru, Akademi berbagi, Mataharikecil Indonesia, and many more. These volunteers took the initiative, cared, and were willing not to be paid to teach and educate students from the poor to keep getting access to education. The volunteers' willingness was based on various motivations, such as the desire to share knowledge, experiences, and
personal expertise, as well as motivation, to contribute to overcoming educational problems as a form of self-existence in society [4]. Like the voluntary theory stated in Munro [5], that is, volunteerism is the desire of a person to help others without expecting a reward in the form of wages or material benefits.

However, based on the interview and observation from one of the small social communities, Mataharikecil, it was found that the teaching volunteers who participated were young people who came from different educational backgrounds such as management, engineering, social, and others. The volunteers who do not have a background in science education do not know the procedures for arranging systematic learning, starting from planning, implementation, to evaluation. Of course, this can have a direct impact on the quality of teaching provided to students. These findings are in line with Lili and Yingjin research [6] which conducted an empirical investigation of the challenges of volunteer teaching in China, which is the low level of specialization in teaching and social services. In fact, to become a teacher requires the following skills, such as the ability to understand the vision and mission of national education, the skills to transfer knowledge to students effectively, understand the concept of children’s psychological development, understand the ability to organize the learning process, have the creativity and the art of educating [7].

The results of some previous studies regarding efforts to improve the quality of volunteers in the voluntary teaching program, that is the development of new models for volunteer development including creating communities for study and practice related lessons, involving repeated 4-H cycles of volunteers learning together, and improving their pedagogical practice skills [8]. Moreover, there is also research that develops a digital platform that contains a catalog of the AppInventory application, organized by applying an original taxonomy where users can browse applications to get benefits using a visual approach and semantic relationships [9]. Other research results discuss the relationship between voluntary teaching and learning models in the Covid-19 pandemic era by developing a voluntary teaching model in online learning which involves three subjects, there are volunteers, target customers, and supervisors [10]. According to the author’s comprehension, there is no explicit work was dedicated to provide a digital platform such as web-based application that can help volunteer teachers in the learning process, starting from preparation, implementation, to evaluation of the learning process in voluntary teaching program in Indonesia.

Based on the urgency of the need to support the improvement of teaching quality provided by volunteers and the findings of previous studies, so the purpose of this research is to provide a digital platform that can help volunteer teachers in the learning process, starting from preparation, implementation, to evaluation of the learning process. The research proposes the developing of EDGIV, a web-based application that can provide guidance for volunteers teacher to create a structured and systematic teaching and learning system. So, it is expected that teaching volunteers can provide quality and standardized teaching for every student, and also make a learning process more enjoyable both for teachers and students.

2. Methods
The methodology used in building a web-based learning system application uses the methodology to design and system analysis that has been recognized by best practices to provide a stable and planned process description, is the Framework for the Application of System Thinking (FAST) [11]. The development of information system design using the FAST framework in outline consists of 8 stages, there are Scope Definition, Problem Analysis, Requirements Analysis, Logical Design, Decision Analysis, Physical Design and Integration, Construction and Testing, Installation and delivery. However, not all stages will be discussed, this research will focus on the Scope Definition, Problem Analysis, Requirements Analysis, Logical Design, Decision Analysis stages which are stages one to the fifth of the FAST stage. An overview of the EDGIV application development process using the FAST method can be seen in Figure 1.

The FAST method begins by defining the scope of the system, problems, opportunities, and desires that trigger the creation of the system (Scope Definition), then a detailed analysis of the voluntary teaching organization’s business process, objectives, and input from the old system can be used as a new
system (Problem Analysis), then analyze the system requirements needed from the initial stage to the final stage (Requirements Analysis). Furthermore, data modeling design is carried out using Entity-Relationship Diagrams (ERD) and process modeling using Data Flow Diagrams (DFD) (Logical Design). Then the next process is carried out analysis and identification of the best solutions from various alternatives for system needs from the aspects of digitizing business processes, software, and hardware (Decision Analysis). After that, is carried out a mapping of the user needs into a system model that illustrates the implementation of the system being built (Physical Design and Integration). The next stage is the development process and testing of the teaching and learning system application which consists of a source code design (Construction and Testing). The final stage is the installation and acceptance of feedback from the end-user of the system (Installation and Delivery).

Figure 1. System design and analysis methods.

3. Results and discussion
This section discusses the follow-up to the application of the FAST framework to design and analyze the EDGIV system as described in the Method section to suit the research objectives [11]. It should be noted that the development of EDGIV will be implemented in a social education community called Mataharikcil Indonesia so that each process described in this section is adapted to the realities of the conditions and problems experienced by the Mataharikcil Indonesia community. Next will be explained in detail the design and analysis stages of the EDGIV system.

3.1. Scope definition
The process of developing EDGIV begins with conducting interviews and direct observation of the voluntary teaching system in the Indonesian Small Mataharikcil Community. From these activities, findings were obtained in the form of system scope, problem formulation, and stakeholder desires that determine the EDGIV system model.

As the output of this stage can be seen in Figure 2, is a project statement documentation that needs to be agreed upon by the stakeholders involved in this research. It is very important to involve all stakeholders from the start, because so that each stakeholder understands the scope of the system and minimizes changes that arise in the future.

Figure 2. Project scope statement of EDGIV.
The project scope statement explains the description of the scope, project deliverables, acceptance criteria, constraints, and assumptions from the development of EDGIV. This project scope statement will be the basis/reference for the next stages. If in the future there are changes or new requests that affect the continuity of this research, then the project scope statement needs to be changed again.

3.2. Problem analysis
At this stage, an in-depth analysis of various aspects of the problem has been identified, such as the formulation of the organization’s business process that implements the voluntary teaching system, organizational goals, and insights from the previous system that can be used in the new system as a reference for development [11]. The following is an explanation of the stages of the analysis problem can be seen in Table 1.

| Problem                          | Cause                              | Solutions                                                                 |
|----------------------------------|------------------------------------|---------------------------------------------------------------------------|
| Volunteer teachers do not know how to plan the learning process | Volunteer teachers are not from the education department | Volunteer teachers refer to the syllabus and teaching materials in EDGIV |
| Volunteer and student attendance records are difficult to track | Class monitoring is still manual | The volunteer teacher records classroom monitoring on the form in the EDGIV tracking menu |
| Student learning outcomes are difficult to evaluate | Volunteer teachers do not have the ability to evaluate student learning outcomes | EDGIV needs to provide a form that refers to a standardized assessment format template |
| Volunteer teachers cannot manage the class well | Volunteer teachers do not have pedagogical abilities | EDGIV needs to accommodate knowledge sharing among volunteer teachers, which can be in the form of an FAQ |

3.3. Requirements analysis
The next stage analyzes the system requirements needed from the initial stage to the final stage based on the scope definition and problem analysis can be seen in Table 2. Requirements Analysis discusses three users, and their Interface Requirements, requirements specifications, information requirements that necessary for EDGIV to function optimally.

| Users               | Application Requirements   | User Interface Requirements          | Requirement specifications | Information Requirements |
|---------------------|---------------------------|-------------------------------------|----------------------------|--------------------------|
| Admin               | All                       | Front end and back end              | Input user database        | username and password    |
| Managements data of learning material, profiles, rules, etc. | All | Learning materials interface, tracking interface | Input data of learning material, input the profiles, input the rules. | Course material, regulations of education, etc. |
| Volunteers          | Record of presences, score, and notes | Learning materials tracking | Input data of presences, score, and material notes. | Students profiles, course material, etc. |
3.4. Logical design
At the logical design stage, it is carried out to document the previous stages using a system model image that describes the data structure and data flow [11]. Refer to Sabah and Yousef [12] the design of process modeling uses Data Flow Diagrams (DFD) and data modeling uses Entity-Relationship Diagrams (ERD).

![Data flow diagram of EDGIV.](image)

In figure 3 it is explained that there are 3 entities involved, namely Admin, management, and volunteers. Each of these entities has its own role in the EDGIV system. While the description of the relationship between data and entities in EDGIV is explained in figure 4 through the following Entity Relationship Diagram (ERD). Figure 4 also explain the role of any entities inside EDGIV, and possible data generated and required by each entity. Main entity is subject because each entity is related to subject in carrying out its duties in EDGIV.

![Entity Relationship Diagram (ERD) EDGIV.](image)

3.5. Decision analysis
The decision analysis process analyzes and identifies the best solution from various alternatives for system requirements which then becomes the application architecture and system proposal [11].
By using the approach of problem structuring approaches (PSMs) and doing scenario planning [13], it can be concluded that EDGIV has 3 main features that can be seen in figure 5. These features are proposes to solve Voluntary Teaching problem in Mataharikecil Foundations, such as: Provision of learning materials in the form of: syllabus, reference books, question banks, and so on. Monitoring the implementation of learning (Course Tracking) in the form of: notes on lecture activities, teacher and student attendance lists, assessment of learning activities, and so on. And finally the Course Administration, in the form of: teacher and student profiles, regulations, regulations, curriculum guides, and so on.

4. Conclusion
The problem of volunteer teaching difficulties because there is Low level of specialization in teaching is expected to be resolved by EDGIV. EDGIV is designed to use a system design and analysis methodology framework that has been recognized by best practices to provide a stable and planned process overview resulting in 3 main features, namely: provision of learning materials following the curriculum set by the government, tracking features that monitor the learning process to administrative features. Which supports the learning process. It is hoped that volunteer teachers will find it easy to use EDGIV so that they can help them to provide access to quality education.

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