DESIGNING AN ELEMENTARY SCHOOL ACADEMIC COLLABORATION SYSTEM USING TOGAF ADM FRAMEWORK

Vladimir Ivan Koroh[1*], Dony Martinus Sihotang[2], Bertha Selviana Djahi[3]
[1, 2, 3]Universitas Nusa Cendana, Fakultas Sains dan Teknik, Program Studi Ilmu Komputer
[1]Email: ivankoroh46@gmail.com[1*],
[2]Email: dmsihotang@staf.undana.ac.id[2],
[3]Email: bertha_djahi@staf.undana.ac.id[3]

ABSTRAK

Kolaborasi di sekolah dasar memainkan peran penting dalam mendukung aktivitas pembelajaran siswa, terutama keterlibatan guru, orang tua, siswa, dan administrasi sekolah. Sayangnya, komunikasi konvensional yang membutuhkan waktu formal dan terjadwal, tidak efektif untuk mendukung kolaborasi di sekolah. Dengan demikian, penelitian ini mengarah pada pencapaian tujuan yaitu mengembangkan sistem kolaborasi akademik yang berjalan di sekolah dasar dan berdasarkan konsep e-kolaborasi yang dapat mengintegrasikan banyak pihak di dalam sekolah dasar. Sistem ini dikembangkan menggunakan pendekatan TOGAF ADM, dimulai dari fase Preliminary dan Architecture Vision dan hanya melalui lapisan inti yang meliputi Arsitektur Bisnis, Arsitektur Sistem Informasi, dan Arsitektur Teknologi. Metode pengumpulan data yang digunakan adalah observasi, wawancara dengan pihak sekolah, dan penelitian literatur., dan pengujian sistem dilakukan dengan User Acceptance Test (UAT). Ada 30 koresponden dalam UAT dan itu menunjukkan bahwa sistem memiliki penerimaan yang luar biasa dengan skor rata-rata adalah 92,79% yang melampaui ukuran 90%. Dinyatakan bahwa sistem telah berhasil memfasilitasi kolaborasi akademik yang terjadi dalam fitur inti di dalam sistem yang dikembangkan. Terdapat manajemen kehadiran siswa, log aktivitas siswa, laporan perkembangan akademik siswa, dan modul obrolan. Oleh karena itu, sistem ini dapat menjadi solusi inovatif bagi sekolah untuk membentuk ekosistem kolaborasi yang dinamis dan efektif.

Kata Kunci : TAM, Dompet Digital, Persepsi Kemudahan, Persepsi Manfaat, Persepsi Sikap Penggunaan

ABSTRACT

Collaboration in elementary school plays a vital role for supporting student learning activity, especially teachers, parents, students, and school administration involvement. Unfortunately, conventional communication in which require formal and scheduled time, are not effective to support collaboration in school. Thus it led to this research to achieve an objective which is to develop an academic collaboration system that runs in elementary school and based on e-collaboration concepts which could integrate many parties inside an elementary school. The system was developed using the TOGAF ADM approach, starting from the Preliminary and Architecture Vision phases and only through core layers which include Business Architecture, System Information Architecture, and Technology Architecture. Data collection method that used are observation, interview

with school parties, and literature research., and the system testing are executed with User Acceptance Test (UAT). There are 30 correspondents in UAT and it shows that system has an outstanding acceptance with average score is 92,79% which beyond the measure of 90%. It is declared that the system has successfully facilitate academic collaborations which occur in core features inside the developed system. There are student presence management, students log activity, student academic progress report, and chat module. Therefore, the system could be innovative solution for schools to form a collaboration ecosystem that are dynamic and effective.

Keywords : e-collaboration, TOGAF ADM, elementary school information system, academic collaboration, UAT

1. INTRODUCTION

Collaboration is one of the key components in the educational ecosystem, especially at the primary school level, which serves as the foundation of children's education. Interaction among students, teachers, parents, and school administrators is an essential factor supporting the development and success of students during classroom learning activities. Involving all stakeholders can create a conducive learning environment, establish coordinated support plans for students, and enable effective communication among decision-makers [1].

However, traditional communication in primary schools tends to be formal, periodic, and time-limited, which makes it ineffective in supporting ongoing engagement [2]. The concept of electronic collaboration (e-collaboration) has emerged as an advancement in information and communication technology, offering flexibility and continuous interaction through electronic media [3]. In primary school environments, e-collaboration is not only beneficial as a learning tool for students but also allows teachers, parents, and school administrators to interact actively during the students' learning processes. Additionally, e-collaboration enables collaboration among teachers in designing lesson materials, allows parents to monitor children's academic progress, and improves coordination in school-level decision-making [4].

Nevertheless, existing electronic media such as School Information Systems are primarily database-oriented and have not fundamentally accommodated the dynamic needs of e-collaboration. These systems are often limited to administrative functions or one-way communication, without facilitating direct intervention or active multi-party collaboration [5]. Furthermore, barriers such as low digital literacy among teachers and parents, as well as limitations in IT infrastructure at some schools, pose significant challenges to adopting e-collaboration solutions [6].

Several previous studies have highlighted the benefits of e-collaboration in education but have mostly focused on higher education or a single stakeholder, leaving a gap in research on comprehensive, multi-stakeholder e-collaboration in primary schools [7], [8]. These research gaps highlight the need for a holistic system that integrates all components of the primary education ecosystem.

To address these issues, this study aims to develop an academic collaboration system designed using the TOGAF Architecture Development Method (ADM), starting from the Preliminary and Architecture Vision phases up to the core layers (Business, Information, and Technology Architecture). The system integrates key stakeholders—students, teachers, parents, and school management—to create a dynamic, inclusive, and effective collaboration ecosystem in a primary school environment. The research is conducted at

SDK St. Maria Assumpta, Kota Kupang, Indonesia, serving as a case study to demonstrate practical implementation and effectiveness.

Among various enterprise architecture frameworks such as Zachman Framework, FEAF, and Gartner, TOGAF ADM was chosen due to its flexibility, comprehensive structure, and suitability for phased implementation in educational institutions. TOGAF ADM enables systematic identification of business processes, stakeholder roles, data flow, and technology infrastructure. Unlike other frameworks that often emphasize business or IT alignment in large-scale enterprises, TOGAF ADM can be tailored to the specific needs of smaller institutions such as primary schools, allowing step-by-step development without compromising architectural integrity. Its structured approach makes it an ideal choice for modeling collaborative ecosystems involving multi-role users in an educational setting.

2. RESEARCH METHOD

RESEARCH APPROACH METHODS

This research employed a qualitative approach with a case study method at SDK St. Maria Assumpta, Kota Kupang, Indonesia. Data collection consisted of three techniques:

- **Observation**: conducted directly during class activities and school administration processes.
- **Interviews**: held with key informants, especially the Vice Principal for Student Affairs, to identify business rules, academic activities, and pain points in current collaboration methods.
- **Literature Review**: to analyze existing research related to e-collaboration in education and the implementation of enterprise architecture frameworks.

SYSTEM DEVELOPMENT

The system was developed with TOGAF Architecture Development Method (ADM) which is described in Figure 1 and only up to its core layers:

- **Preliminary Phase & Architecture Vision**: defining system objectives and scope.
- **Business Architecture**: modeling school workflows including attendance recording, assignment submission, daily activity logging, and academic reporting.
- **Information System Architecture**: designing system modules with CodeIgniter 4 and MySQL database schema.
- **Technology Architecture**: preparing a web hosting infrastructure to make the system accessible to teachers, students, parents, and administrators.

ISSN: 2337-7631 (printed)
ISSN: 2654-4091 (Online)

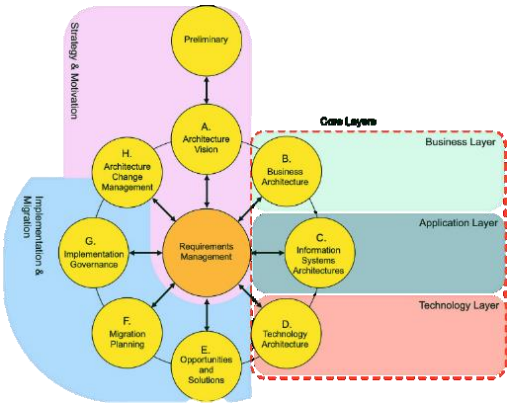

Figure 1 TOGAF ADM

The choice of CodeIgniter 4 as the web framework is driven by its lightweight structure and modular design, which aligns well with the layered architecture proposed by TOGAF ADM. CodeIgniter supports MVC (Model-View-Controller) pattern that helps in separating system logic, data handling, and presentation, ensuring maintainability and scalability of the application. Meanwhile, the MySQL database provides structured relational storage to manage academic data such as attendance, task submissions, and report generation efficiently. The combination of these technologies allows rapid prototyping and deployment while supporting the implementation of secure access levels for different user roles (teacher, parent, student, administrator). Furthermore, the system was developed with responsive design principles to ensure usability across multiple devices, considering the variation in user digital access levels.

USER ACCEPTANCE TESTING (UAT)

System evaluation was conducted using UAT with a total of 30 respondents comprising:

- Teachers (15 respondents, 50%)
- Parents (9 respondents, 30%)
- Students (6 respondents, 20%)

The UAT instrument measured four variables—Functionality, Reliability, Usability, and Efficiency—each assessed through a 5-point Likert scale, then converted into percentage scores.

RELATED WORK

Previous studies in the domain of e-collaboration and information systems for education have largely centered around higher education settings. For instance, examined the impact of digital collaboration on lecturers' academic performance, highlighting increased productivity and engagement [1]. Another example is a designed e-collaboration application tailored to manage final-year student projects [3]. While such systems are effective in their respective contexts, they often do not account for the complexity of collaboration at the primary school level involving students, parents, teachers, and administrators.

A discussion for significance of teacher collaboration for inclusive education and differentiated instruction. However, their work focused more on pedagogical practices than system-level integration [4]. Moreover, a study that explored TOGAF implementation in university environments, showing strong alignment between business processes and system architecture [8].

Compared to existing research, the present study is unique in two aspects. First, it applies TOGAF ADM specifically in a primary school context, a domain that has seen limited adoption of enterprise architecture methodologies. Second, it integrates multiple stakeholders through a centralized system, creating a collaborative ecosystem beyond administrative operations. These distinctions reinforce the novelty and practical relevance of this research.

3. RESULT AND DISCUSSION

TOGAF ADM IMPLEMENTATION

A. Architecture Vision

In this initial phase, the objective, scope, and high-level system vision were established. Through interviews with the Vice Principal for Student Affairs, it was identified that the current academic communication and collaboration relied heavily on manual methods and periodic meetings. The system was envisioned as a centralized platform facilitating real-time collaboration between teachers, students, parents, and school administrators.

B. Business Architecture

This phase involved modeling the academic and administrative processes of the school. Key processes such as attendance tracking, assignment distribution, student activity logging, and academic performance reporting were identified. Stakeholder interactions were mapped, and a functional decomposition diagram was created to describe system services that align with stakeholder needs.

Through this phase, it could also determine the business process and school's academic activity by performing an interview. Not only contributing to data collection, interviewing could also help to better providing particular activity and rules inside the school. In Table 1 is a rehearsed interview with the SDK Sta. Maria Assumpta Student's Department Counselors.

Table 1 Interview results

No	Question	Answer
1.	How many active students in SDK Sta. Maria Assumpta?	There are 779 active students in SDK Sta. Maria Assumpta
2.	How many is the class division in this school?	Class division: 1st Grade = 5 Class; 2nd Grade = 5 Class; 3rd Grade = 4 Class; 4th Grade = 4 Class; 5th Grade = 5 Class; 6th Grade = 4 Class.
3.	Is there a fix homeroom teacher? How often they are switched?	Homeroom Teacher usually fixed up until the end of academic year.
4.	How much student in each grade and its division?	There is a limit for how much student in a classroom and mostly 30 students.
5.	Who's in charge to do student's daily presence?	The homeroom teacher, and there are some teachers in charge to write down late attendance.
6.	When exactly the student's daily presences take place?	Presence was done during lessons.
7.	How about the regulation on student's daily presence?	There is a various penalty towards presence violation. Start from immediate warning, deliver a warning letter, and the highest is expulsion.
8.	How about the presences report and its flow inside the school?	It usually ends up on the student's final report and only its present and absent total
9.	How does the school commit the student admission?	Still using an conventional way with papers and needs to be sorted manually.
10.	How about the criteria for student candidate?	Have an proper identification.
11.	How does the school design lesson schedule for teachers?	Lesson schedule are the Curriculum Department responsibility, but teachers could still submit their own designed lesson schedule.
12.	Provided extra information.	• Lesson that need specific teacher: English, Sports, Catholic Religion, and Arts. • Lesson that could be teach by homeroom teacher: Mathematics, Indonesian, Science, Social Science, Local Culture and Cuisine. • Student needs to attend the morning assembly at 6:45 AM sharp, later that that were considered late and given penalty and warning.

No	Question	Answer
		• Presence calculation (%): (Total Student Attendance * 100)/Effective School Day • If student attendance percentage were below 80% a warning would be delivered to parents, and excessive violation could result in detention, and expulsion.

Entities were structured using a Use Case Diagram that is illustrated on Figure 2, while a Data Flow Diagram (DFD) was used to visualize data movement between modules and users, furthermore the illustration on Figure 3 and Figure 4 is to describe Data Flow Diagram level 0 or known as Context Diagram and Data Flow Diagram level 1. There are also Figure 5 and Figure 6 to illustrate business rules on student's presence process and class studying process.

C. Information System Architecture

System architecture was designed to support collaborative features including:

- Attendance and grading modules
- Assignment and material management
- Activity log and chat features
- Academic report generation

This architecture is specifically designed to implement the scheme that has been fixed on Business Architecture. Even so, there are still a possibility of changes while executing this phase by using the requirement management.

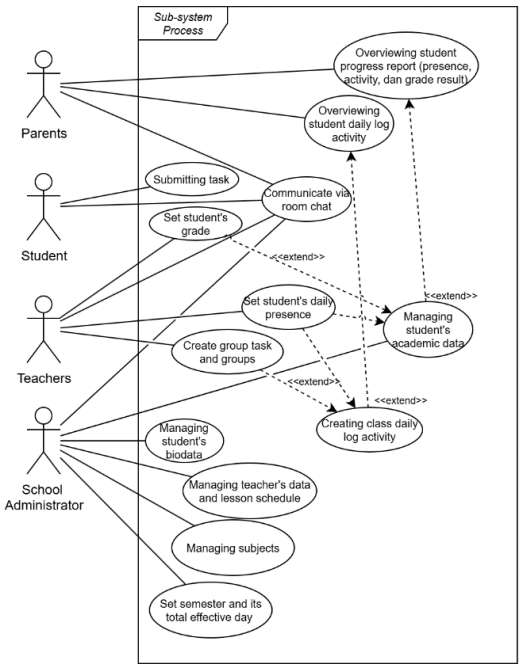

Figure 1 Use Case Diagram Elementary School

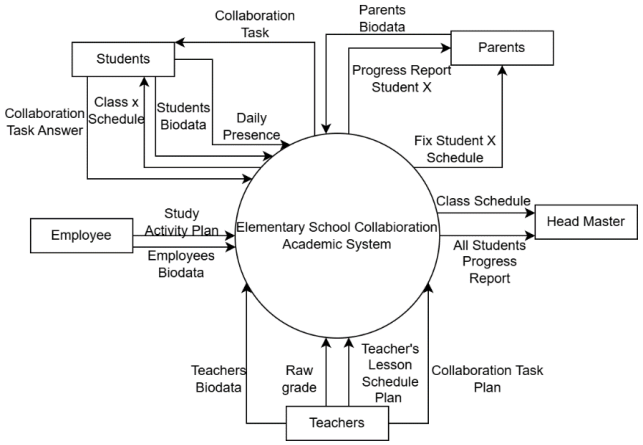

Figure 2 Context Diagram

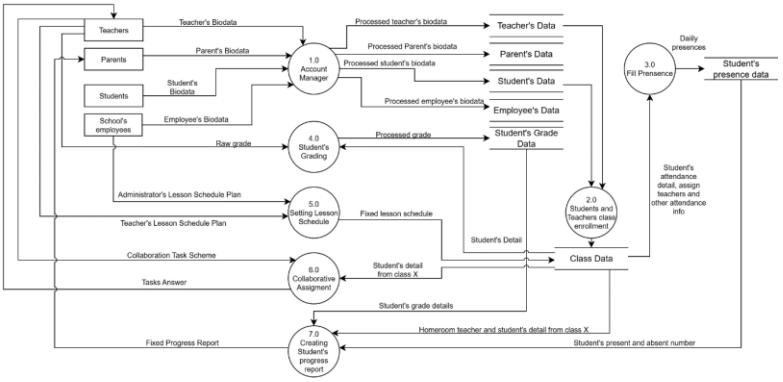

Figure 3 Data Flow Diagram Level 1

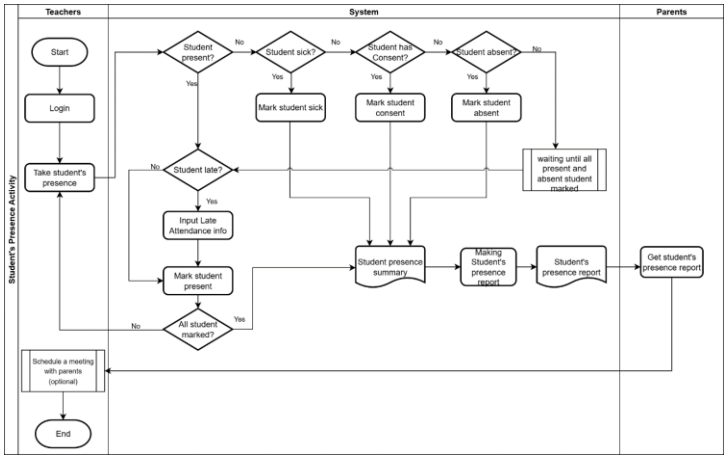

Figure 4 Student's Presence Activity Diagram

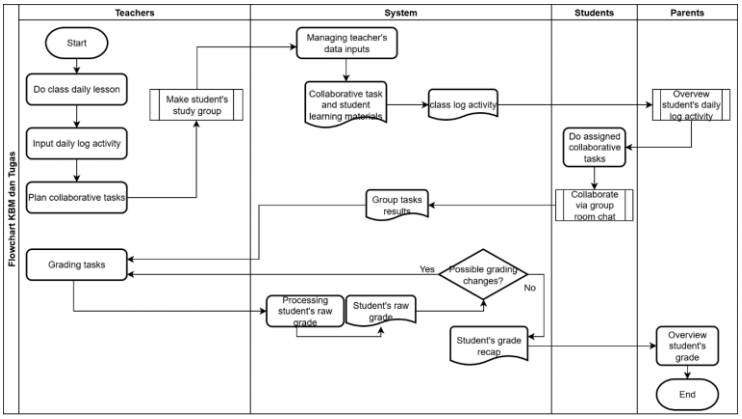

Figure 5 *Class Studying Activity Diagram*

D. Technology Architecture

In this phase, the technical implementation was specified. The system was developed using CodeIgniter 4 and MySQL and deployed on an external web hosting server. It supports multi-role access and is optimized for desktop and web-mobile usage. The architecture includes user authentication, access control, backup mechanisms, and data security protocols.

But considering time limitation on conducting this research while also designing and developing the system, this phase would only do coverages basic user authentication and security protocols. For the backup mechanism and data security protocols are to be determined later.

Table 2 Identified Gap and Proposed Solution

No	Identified Gap	Proposed Solution
1	No centralized platform for teacher-parent-student collaboration	Develop a web-based system with multi-role access
2	Absence of real-time communication and activity tracking	Integrate chat and daily log modules accessible to parents and teachers
3	Manual attendance and grade recording	Implement digital attendance and grading modules connected to user dashboards
4	Lack of automatic academic reporting	Provide printable academic report features for school management and parents
5	Low digital readiness among some users	Include user training modules and guided interfaces

E. Migration Planning

This phase involves defining a transition roadmap, identifying the sequence of implementation activities, and prioritizing system components. Based on readiness and stakeholder urgency, the following project priorities were established on Table 3.

Table 3 Migration Planning's Priority

No	Project Component	Priority Level
1	Development of core LMS (attendance, tasks, grades)	High
2	Integration of user roles (teacher, student, parent)	High
3	Implementation of chat and activity log modules	Medium
4	Academic report generation and printable export	Medium
5	User training and digital literacy support	Low

These stages ensure that the system rollout is progressive, manageable, and aligned with the school's operational priorities.

F. Implementation Governance

Implementation governance ensures that the system adheres to its intended architecture, quality standards, and performance expectations. At SDK St. Maria Assumpta, the following governance structure was proposed:

- System Administrator: responsible for platform configuration, account creation, and technical maintenance.
- Academic Coordinator: oversees content consistency and supervises teacher data entry.
- Principal: acts as the system's policy leader and oversees compliance with the school's educational goals.

Regular evaluations and feedback loops are integrated to ensure sustainable use and continuous improvement of the platform.

G. Architecture Change Management

This phase defines how architectural changes will be assessed, approved, and implemented. Since academic needs and digital literacy evolve over time, the system was designed with modular architecture, allowing:

- Addition of new features (e.g., student feedback forms, analytics dashboards).
- Interface adjustments based on user feedback.
- Periodic reviews of system usage and feature relevance.

Any change requests will follow an internal workflow involving consultation with teachers, technical staff, and school leaders before deployment.

USER ACCEPTANCE TEST RESULTS

Based on UAT results from 30 respondents, which includes 15 teachers, nine parents and six students as user representatives. The average scores are summarized in Table 5.

Table 4 UAT Average Scores by Variable

No	Variable	Average Score (%)
1.	Functionality	91.34
2.	Reliability	94.00
3.	Usability	92.16
4.	Efficiency	93.67
Total		**92.79**

SYSTEM USAGE SCENARIO

To better illustrate how the system facilitates collaboration, consider the following scenario: a teacher logs into the platform to upload assignments and record daily attendance. Parents receive immediate notifications and access these records from their respective dashboards. A student

ISSN: 2337-7631 (printed)
ISSN: 2654-4091 (Online)

who has been absent for two consecutive days automatically triggers an alert for the academic coordinator, who can then follow up via the integrated chat module.

The system's workflow ensures all stakeholders remain informed and engaged. Teachers are empowered to manage learning activities, while parents gain real-time insight into their children's academic journey. Students, on the other hand, can access materials and submit work without delay. Such interactions align well with the TOGAF-modeled business processes and demonstrate the value of a well-structured architecture in enhancing educational collaboration.

4. CONCLUSION

This study successfully designed and developed a web-based academic collaboration system for primary education using the TOGAF ADM framework. The system effectively integrates teachers, students, parents, and school management into a dynamic and interactive platform, enabling timely and effective academic communication. The positive UAT results with an overall acceptance score of 92.79% demonstrate the system's suitability and potential as a model for implementing e-collaboration in other primary schools. The application of TOGAF ADM ensures that the system aligns well with the business processes of the school, supporting comprehensive academic collaboration.

REFERENCES

[1] B. A. A. Al-khateeb, "E-Collaboration and Academic Performance of Lecturers: Evidence From a Jordanian University," *International Journal of e-Collaboration*, vol. 20, no. 1, pp. 1–15, Apr. 2024, doi: 10.4018/IJeC.342480.

[2] A. P. Kusuma and A. Yufron, "ANALYSIS OF USER ACCEPTANCE TESTING ON A SHIPPING APPLICATION TO DETERMINE THE QUALITY OF THE SYSTEM," *antivirus*, vol. 18, no. 2, pp. 234–243, Nov. 2024, doi: 10.35457/antivirus.v18i2.4002.

[3] R. Lounas, I. Hamzaoui, N. Bouguelmouna, and H. Mokrani, "An E-Collaboration Application for Final-Year Project Management," *International Journal of e-Collaboration*, vol. 19, no. 1, pp. 1–17, Jan. 2023, doi: 10.4018/IJeC.315787.

[4] M. Pozas and V. Letzel-Alt, "Teacher collaboration, inclusive education and differentiated instruction: A matter of exchange, co-construction, or synchronization?," *Cogent Education*, vol. 10, no. 2, p. 2240941, Dec. 2023, doi: 10.1080/2331186X.2023.2240941.

[5] H. Liu, B. Kim, and S. Joines, "Collaborative Writing in the Intelligence Community: Investigation of Analytic Collaborative Reporting Processes and Writing Strategies," *International Journal of e-Collaboration*, vol. 19, no. 1, pp. 1–26, Jun. 2023, doi: 10.4018/IJeC.324110.

[6] E. Tazhibayeva and T. Dolidze, "Gains of e-collaboration in professional engagement initiatives," *Bul. Kar. Univ. Ped. Ser.*, vol. 102, no. 2, pp. 78–83, Jun. 2021, doi: 10.31489/2021Ped2/78-83.

[7] A. B. Purba, A. Mubarok, and J. Mulyana, "Enterprise architecture design using TOGAF at foundation of triputra persada horizon education," *Ilk. J. Ilm.*, vol. 13, no. 2, pp. 155–162, Aug. 2021, doi: 10.33096/ilkom.v13i2.847.155-162.

[8] U. Ulmi, A. P. G. Putra, Y. D. P. Ginting, I. L. Laily, F. Humani, and Y. Ruldeviyani, "Enterprise Architecture Planning for Enterprise University Information System Using the TOGAF Architecture Development Method," *IOP Conf. Ser.: Mater. Sci. Eng.*, vol. 879, no. 1, p. 012073, Jul. 2020, doi: 10.1088/1757-899X/879/1/012073.
[9] M. Seidl, M. Scholz, C. Huemer, and G. Kappel, *UML @ Classroom: An Introduction to Object-Oriented Modeling*. in Undergraduate Topics in Computer Science. Cham: Springer International Publishing, 2015. doi: 10.1007/978-3-319-12742-2.
[10] I. Afrianto, A. Heryandi, A. Finadhita, and S. Atin, "User Acceptance Test For Digital Signature Application In Academic Domain To Support The Covid-19 Work From Home Program," vol. 5, no. 36, 2021.

ISSN: 2337-7631 (printed)
ISSN: 2654-4091 (Online)