ICT-Based Application Module

System Design

“Right Decisions for Effective Education-

Strengthen Education for All Children!”

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Content

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Introduction

This project has set out with the aim of facilitating teachers' work in the field and using decision-making mechanisms more effectively. For this purpose, firstly, the project needed to focus on the design of the application. A set of work was completed collaboratively in the development of the design. Although not proposed in the project, these tasks were identified as needs analysis, determination of the outcomes to be embedded in the application, examination of country systems, use of ICT-based design principles in the literature, and contributions of the project trainings.

The process started with the needs analysis. The Turkish partners first developed the data collection tools and then finalized them after receiving feedback from other partners. After the data collection process, the planned trainings completed by the Finnish and Dutch partners structured ideas on data recording and environment development for students' performance indicators in school environments.

The literature on developing an ICT-based application was analyzed, and the points to be considered in developing a user-friendly recording tool were identified.

Finally, the European approach was incorporated into the application development process based on the knowledge gained from the trainings completed in Finland and the Netherlands.

The report on these processes is presented below.

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Needs Analysis

Determination of Teachers' Needs for Data-Based Decision Making and Technology Use Skills

Many problems that schools face do not have specific solutions. However, while acting quickly on an issue or problem may feel efficient, acting without data is often ineffective (Schildkamp, 2019). If the cause or causes of low student achievement are elsewhere, the problem may remain unresolved or worsen. Such situations waste time and money, let alone improve student performance. Therefore, it is important to use data to identify the causes of a problem first and foremost (Schildkamp, 2019).

Data use can be defined as collecting and analyzing data about the components and outcomes of educational programs to maximize learning outcomes (Schildkamp & Earl, 2013). Although data use is widely used in many fields (Feng et al., 2016), using educational data by teachers in the classroom environment is not common (Kaufman et al., 2014). Teachers have significant difficulties using data for their teaching effectiveness and adaptations (Datnow & Hubbard, 2016; Mandinach & Gummer, 2013; Raffe & Loughland, 2021). For this reason, teachers often adapt their teaching by considering their experiences and intuitions (Schildkamp & Kuiper, 2010) rather than systematically collecting data (Ingram et al., 2004). However, data should be systematically recorded, analyzed, and adapted for educational arrangements to increase effectiveness and efficiency. Systematically collected data are expected to provide teachers with feedback on the level of achievement of learning outcomes, the effectiveness of the methods they apply, and how efficiently they use time (Hamilton et al., 2009; Marsh, 2012; Means et al., 2009). In this way, teachers can adapt their teaching programs and achieve more effective results on student outcomes.

In the literature, various terms are used in connection with the use of data in schools, corresponding to decision-making based on available data. Some of the terms used are data-driven decision-making (Ehren & Swanborn, 2012; Ikemoto & Marsh, 2007; Mandinach, 2012), data-based decision-making (Filderman et al., 2018), and data-based individualization (Jung et al., 2018; Lembke et al., 2018) (Blumenthal et al., 2021). Although the terms are comparable, data use in school systems has different interpretations. These differences can largely be attributed to what is meant by the term data, what requirements the data should fulfill, and what decisions should be made based on the data. Given the prevalence of terms, data-driven decision-making can be used to capture common terminology (Blumenthal et al., 2021).

Data-based decision-making can be defined as the systematic collection, analysis, examination, and interpretation of data to guide practice in educational settings (Mandinach, 2012). Therefore, in the data-driven decision-making process, problems are identified, data are collected, analyzed, and transformed into information, decisions are made, and the results are re-evaluated (Mandinach & Gummer, 2016). Therefore, if data-driven decision-making processes are carried out, teachers are expected to deliver curricula more effectively and make progress on student outcomes (Schildkamp & Kuiper, 2010).

Data-driven decision-making often involves the use of ongoing progress data. Such data appear on a graph in the decision-making process. For instructional adaptations, teachers need to understand and interpret progress graphs. However, teachers vary in their ability to understand and interpret graphs and often have difficulty interpreting even simple graphs (Canham & Hegarty, 2010; Friel et al., 2001;

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Shah & Freedman, 2011). For this reason, to facilitate the work of practitioners, handling data and goal-oriented planning by utilizing the opportunities provided by digital technology can be an important tool in facilitating the process and progressing more effectively.

Digital technologies are electronic tools, systems, devices, and resources that store, generate, or process data (Loong & Herbert, 2018). These technologies include social media, online applications, multimedia, cloud computing, interoperable systems, and mobile devices (Churchill, 2017; Churchill & Hedberg, 2018). In recent years, there has been a marked increase in the reach of digital technologies, which are increasingly applied in teaching and learning (Churchill et al., 2018). Digital technologies can guide teachers to make learning more effective by recording and visualizing students' behaviors (McKenney & Mor, 2015). In this way, teachers can identify which students need urgent support and which are progressing and having difficulty completing the task (Mavrikis et al., 2019). In addition, mobile technology such as tablets and smartphones with digital applications are becoming accessible to many classroom users at all levels of education (Dhir et al., 2013; Kinash et al., 2012). Therefore, including digital technologies in data-based decision-making processes can reduce teachers' workload and support their skills.

L. Fuchs and D. Fuchs (1989) conducted a literature review to find solutions on how computers can solve the problems teachers face in the data-based decision-making process (Espin et al., 2017). In related and subsequent studies, how software was used for automatic data collection, scoring, graphing, and feedback on instructional adaptations was discussed (Espin et al., 2017; L. Fuchs & D. Fuchs, 1989, L. Fuchs & D. Fuchs, 1989, L. Fuchs & D. Fuchs, 2002; L. Fuchs et al., 2003; Stecker et al., 2005). Research results have shown that computers reduce the workload teachers face in the data-based decision-making process and can improve their decision-making skills (Espin et al., 2017; L. Fuchs & D. Fuchs, 2002; Stecker et al., 2005). However, technology has developed significantly in recent years. Today's technology includes the internet, smartphones, tablets, and more advanced software applications. Therefore, research is needed to determine how today's technology can improve teachers' data-based decision-making skills (Espin et al., 2017).

To successfully address teachers' data use skills and better understand their challenges, research should identify their needs and develop methods to address them (Espin et al., 2021). Therefore, determining the knowledge and skills teachers will need to effectively use a technology-based application for program development and monitoring its impact will be the first step in a targeted development-based process. The first step of the project, whose short name is Decide Right (DR) and of which Gazi University is the coordinator and which is supported within the scope of the Erasmus+ program school education strategic partnerships (KA201) program funded by the European Union, was to determine what teachers know and what they need within the scope of data use and technology. The project aims to provide teachers with data-based decision-making skills using digital technologies about the outcomes of the programs they implement.

The research questions addressed in this context are as follows:

1. What are the needs of teachers for technology use?

2. What are the needs of teachers to carry out a data-based decision-making process?

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Method

Aim of the research and research questions

This study aims to determine the needs of teachers regarding technology and data-based decision-making.

In the context of this general purpose, answers to the following two research questions were sought.

1. What are teachers' needs regarding using technology in evaluating students' development and learning?

2. What are the needs of teachers to carry out a data-based decision-making process?

Research design

This study used a convergent design, in which quantitative and qualitative data are collected simultaneously (Creswell, 2015). The convergent design, which involves separate collection and analysis of quantitative and qualitative data, ultimately aims to combine the results obtained from quantitative and qualitative data analysis. Thus, the perspective provided by the two data types contributes to quantitatively and qualitatively defining the problem. Combining the data contributes to looking at the problem from different views and perspectives. Combining the general trends and relationships revealed by quantitative results with qualitative results revealing individuals' personal views provides more data and a more holistic understanding than quantitative and qualitative databases can provide alone (Creswell, 2015).

The steps for the combined design are as follows.

1. Collect and analyze quantitative and qualitative data separately.

2. Combining or merging two sets of data

There are several ways of combining the data. One is to combine the quantitative and qualitative results and then discuss the conclusions or interpretations from the data sets in a side-by-side comparison display. Another way of combining data is data transformation, which refers to transforming one data set into another so that the data can be compared more easily. A third way is common representations, where quantitative results are presented alongside qualitative results in tables or graphs. In this study, the first one was used to combine quantitative and qualitative data analysis.

3. After combining the results, analyze the extent to which quantitative results are confirmed/disconfirmed by qualitative results or qualitative results are confirmed/disconfirmed by quantitative results, and explain the reasons for this difference if the confirmation criteria differ.

Participants

Quantitative and qualitative research processes and sampling methods should be followed in mixed-method research. In this study, quantitative and qualitative data were collected from a sample of primary school teachers and preschool teachers to identify their needs regarding the use of technology and data-based decision-making in the assessment of development and learning processes.

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Data Collection Tools

In this research, quantitative data were collected through a questionnaire prepared by the researchers titled "Examining Teachers' Levels of Technology Use and Data-Based Decision-Making." The questionnaire consists of two sections. The first section includes demographic information such as gender, age, professional experience, type of school worked, the number of students in the class, the number of inclusive students, etc. It also includes short-answer questions related to smartphone and computer/tablet usage, duration, reasons, frequency, technology use, measurement, and evaluation of whether they received training for teaching methods. The second section of the questionnaire contains 30 questions that require a rating from 1 (strongly disagree) to 5 (strongly agree) to determine the needs of teachers in technology use and data-based decision-making. The questionnaire items were prepared based on relevant literature and research questions.

Qualitative data were collected through individual interviews conducted with a smaller number of participants. I couldn't write about whether there is a relationship between the sample/participants who provided quantitative and qualitative data because I don't know what kind of relationship exists. I also don't have information about the total number of people interviewed. In the interviews, after obtaining some basic demographic information (age, gender, professional experience, branch, school type, number of students, number of students with special needs) from the teachers, the focus was on three fundamental questions related to regularly recording development and learning processes, making adjustments in educational plans according to students' development and learning situations, and determining the supports needed to create environments that support learning.

Data Collection Process

All stages of the research were carried out with the informed consent of the participants and based on voluntariness. After obtaining permission from the Ethics Committee of Gazi University, the online questionnaire form was shared with the teachers in the target group. At the same time, individual interviews were conducted face-to-face and online via Zoom application with teachers who volunteered, according to the teachers' preferences. In the interviews, audio recordings were made with the informed consent of the participants.

Data Analysis

Quantitative data from the questionnaires were analyzed descriptively, and percentages and frequencies were reported. Qualitative data obtained from the interviews were prepared for analysis by converting audio recordings into text, and content analysis was performed.

Findings

Content Analysis of Qualitative Data

The interviews with teachers consist of questions that include information about five different teachers with varying ages, genders, subject areas, school types, and student groups. The text covers the teachers' educational practices, student profiles, learning environments, adaptations, material needs, and monitoring of student development. Here is the brief content analysis of the text:

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Teacher Profiles. The text provides information about the ages, genders, professional experiences, subject areas, school types, and the number of students in each teacher's class. This reflects the diversity and experiences of the teachers.

Student Groups. The text includes information about the students' ages, grade levels, and disability statuses. These are the details used to describe the student groups each teacher works with.

Educational Practices. Each teacher has responded to questions regarding whether they adapt to their educational plans. Some teachers have explained their adaptations in detail, while others have provided reasons for not making them.

Materials and Learning Environments. Teachers have expressed the need for more materials and suitable learning environments to support students' learning.

Student Development and Records. The text addresses questions about regularly recording and monitoring student development. Some teachers have mentioned difficulties and expressed the need for support.

The text focuses on different teachers' educational practices and needs, reflecting their professional experiences and perspectives. These interviews provide essential information about the challenges, requests, and needs of teachers in education.

Analysis of Quantitative Data

76 teachers participated in filling out the questionnaire developed for the quantitative data collection part of the needs analysis. 67.1% of teachers from different branches are women, and 32.9% are men. 39.5% of the participants are between the ages of 30-35. 67.1% are between the ages of 22-35. The number of students in the classroom of 59.2% of the teachers was between 21-30, and 48.7 of the teachers stated that they had inclusive students in their classes. All teachers stated that they use technological tools.

Table 1 below shows the percentage distribution of answers to selected questions. The table presented the questions that directly related to the main purpose of this report.

Six of the selected questions are particularly prominent. When these questions are examined closely, it is seen that the scores given are 3 and above. Commonalities among those six questions are closely related to the priorities of this project. It is seen that teachers give answers to these questions that point to their needs in terms of recording data rather than collecting data and using the recorded data to make data-driven decision-making positively for their students and themselves.

In sum, common points in comparing qualitative and quantitative data are striking. The 15 teachers interviewed and the 76 teachers who completed the survey clearly demonstrated their need for data collection, recording and transformation into information for decision-making processes. This data obtained has a high relationship with the starting point of the project. At the same time, it is clearly seen in the data that the teachers need to know evidence-based practices and the close relationship between method-evaluation and data processing. Thus, this project has once again demonstrated its necessity in all aspects through field work.

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Table 1. Answers to selected questions

	Question/Scale %	1	2	3	4	5
1	I need to benefit from technology for my personal/professional development.	11,8	6,6	13,2	23,7	44,7
2	I need to learn to observe when assessing children.	26,3	22,4	22,4	7,9	21,1
3	I need to learn to record observations when assessing children.	19,7	21,1	28,9	15,8	14,5
4	I need to learn how to interview when assessing children.	21,1	25	25	11,8	17,1
5	I need to learn how to prepare curriculum-based assessments to evaluate children.	18,4	18,4	21,1	21,1	21,1
6	I need to learn how to record evaluation data.	23,7	23,7	13,2	18,4	21,1
7	I need to learn how to use children's assessment data to guide my professional development.	19,7	18,4	23,7	15,8	22,4
8	I need to interpret children's assessment data correctly.	17,1	23,7	18,4	21,1	19,7
9	I need to record student data for decision-making purposes.	13,2	26,3	26,3	14,5	19,7
10	I need to learn how to save data.	18,4	19,7	26,3	17,1	18,4
11	I need to learn to read data graphs.	22,4	22,4	21,1	17,1	17,1
12	I need to learn how to make sense of the data I collect.	19,7	18,4	23,7	21,1	17,1
13	I need to develop educational decision-making skills based on the data I collect.	18,4	14,5	25	21,1	21,1
14	I need a system where I can effectively implement my decisions based on the data I record.	14,5	10,5	27,6	23,7	23,7
15	I need to learn evidence-based teaching methods.	13,2	11,8	30,3	23,7	21,1
16	I need to learn to choose teaching methods based on assessment data.	18,4	15,8	21,1	26,3	18,4
17	I need to learn to include my students in decision-making based on the data I collect.	18,4	13,2	27,6	23,7	17,1

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Study on developmental stages, curriculum analysis, and methods

Turkish partners first carried out a study on the learning programs used by the Turkish education system. A content analysis was conducted on the curriculum used in this study.

Content Analysis

Content analysis is a research method used to systematically and objectively analyze the content of various forms of communication, such as text, audio, video, or visual materials. It is a technique employed in various fields, including social sciences, media studies, marketing, and communication research. Content analysis involves examining the content of messages to identify patterns, themes, and trends, and it can be quantitative and qualitative.

Here are the key components of content analysis:

Data Collection: Content analysis begins with the collection of data, which may be in the form of written text, audio recordings, video clips, images, or any other type of content. Researchers select their data sources based on their research objectives.

Coding: Coding involves systematically categorizing and labeling the content to identify specific elements, themes, or characteristics. This can be done using predefined codes (quantitative content analysis) or by developing codes as the analysis progresses (qualitative content analysis).

Unit of Analysis: Researchers determine the unit of analysis, which can be a word, sentence, paragraph, image, or any other content segment that serves as the basis for coding and analysis.

Coding Scheme: In content analysis, a coding scheme is established, which outlines the categories, codes, and definitions that will be used to analyze the content. This scheme helps ensure consistency and reliability in the coding process.

Coding Process: Researchers review and code the content based on the coding scheme. Quantitative content analysis may involve counting the frequency of specific codes, while qualitative content analysis seeks to identify themes, patterns, and context within the content.

Data Analysis: After coding, researchers analyze the coded data to draw conclusions and identify patterns or insights. This analysis may involve statistical procedures, content-coding software, or qualitative interpretation.

Interpretation: In qualitative content analysis, researchers interpret the findings, often seeking to understand the context, meaning, and implications of the identified themes and patterns.

Reporting: The content analysis results are typically reported in research papers, reports, or presentations. Researchers provide a detailed description of their methodology, findings, and conclusions, often including examples from the analyzed content to support their claims.

Content analysis is a versatile method used to study a wide range of research questions, from analyzing media content and public discourse to understanding the themes in interviews and surveys. It allows

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researchers to systematically examine and make sense of large volumes of data, making it a valuable tool for quantitative and qualitative research.

Curriculum development processes in country education systems can be based on different educational approaches or philosophies. Decision-makers try to choose the most appropriate approaches in line with the conditions and objectives of the countries. The differences between the Netherlands, Finland, and Turkey regarding educational philosophies can be revealed from the documents available on the internet. What was obtained from the content analysis on these documents indicated that the Turkish system is more structured, and the systems of the other two countries are relatively more flexible. In addition, it was observed that the programs of the three countries included a significant developmental approach.

Additionally, it has been noted that teachers have different approaches to their involvement in implementing the programs.

As a result of the content analysis, Turkish partners focused on a group of lessons and outcomes. These courses are also jointly available in the systems of the Dutch and Finnish partners. Since the achievements are different from each other in the selected programs and the Turkish system has been developed in a more fixed and unchangeable way compared to the Finnish and Dutch programs, it has been found more appropriate to proceed through the Turkish system's achievements. Dutch and Finnish systems give teachers more flexibility regarding the curriculum than the Turkish system. While the Turkish system does not allow teachers to make meaningful changes in outcomes, it does give teachers significant freedom in teaching methods and assessment practices. However, Dutch and Finnish systems offer advantages in terms of flexibility throughout.

In this context, we took a conservative approach and took the lowest risk into account during the application development process. For this reason, the Turkish system-based achievement determination process was implemented.

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The Literature Review in ICT-based Application Development

The Project team started with a literature search regarding developing an ICT-based application. The project team started with a literature review to develop an ICT-based application. This review aims to be aware of the problems encountered in the process and to take precautions against possible problems. For this purpose, the literature review tried to answer 3 basic questions: 1) Difficulties in developing ICT-based applications, 2) Effective methods that can be applied in the ICT-based application process, and 3) Principles in ICT-based practice.

The literature review provided information about the difficulties in developing ICT-based applications. Some of the common difficulties mentioned in the literature in ICT application development:

Rapid Technological Advancements: Keeping up with the fast-paced changes in technology, frameworks, and programming languages can be challenging. What's cutting-edge today might become obsolete tomorrow.

Complexity: ICT applications involving intricate software and hardware components can be highly complex. Managing this complexity and ensuring all parts work together seamlessly is a significant challenge.

Security Concerns: Cybersecurity is a constant concern. ICT applications often handle sensitive data and require robust security measures to protect against data breaches and cyberattacks.

Scalability: As user bases grow, applications must scale to handle increased traffic and data. Ensuring an application remains performant and responsive under high loads can be challenging.

Compatibility: Ensuring an application works correctly on various devices, operating systems, and web browsers is a common challenge, especially for web and mobile applications.

Data Management: Managing vast amounts of data efficiently, ensuring data quality, and providing real-time access are essential but challenging aspects of ICT applications.

User Experience (UX): Designing a user-friendly interface and ensuring a positive user experience is a continuous challenge. Meeting the needs of diverse user groups and maintaining intuitiveness is not always straightforward.

Regulatory Compliance: Navigating and complying with evolving data protection and privacy regulations, industry standards, and legal requirements can be complex and demanding.

Testing and Quality Assurance: Identifying and addressing bugs, vulnerabilities, and performance issues through thorough testing and quality assurance processes can be time-consuming.

Project Management: Coordinating a multidisciplinary team, setting priorities, and managing project timelines and budgets require strong project management skills.

Cost Control: Keeping development and operational costs under control is challenging. ICT projects can be resource-intensive, and unexpected expenses can arise.

Interoperability: Ensuring an application can work seamlessly with other systems and technologies, including legacy systems, can be a significant challenge, especially in enterprise contexts.

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User Training and Support: Providing adequate training resources and support for end-users, administrators, and technical staff can be challenging to manage effectively.

Backup and Disaster Recovery: Planning and implementing robust backup and disaster recovery strategies to safeguard data and maintain business continuity can be complex.

Sustainability: Maintaining and updating an application over its lifecycle, ensuring it remains relevant and sustainable, requires ongoing commitment and resources.

Globalization: If the application is intended for a global audience, handling localization, internationalization, and language support can be challenging.

Ethical Considerations: Addressing ethical concerns related to data usage, artificial intelligence, and the impact of the application on society is an emerging challenge.

In developing an ICT-based application, you can apply the following method, often referred to as the Software Development Lifecycle (SDLC). This method provides a structured approach to building software applications. Here's an overview in English:

Software Development Lifecycle (SDLC): The Software Development Lifecycle is a structured approach to developing ICT-based applications. It consists of several phases, each with its own set of activities and deliverables. Here's an outline of the key phases:

Requirement Analysis: Gather and document the project requirements by understanding the needs of the users and stakeholders.

Planning: Create a project plan that outlines timelines, resource allocation, budgets, and risk management strategies.

Design: Design the architecture and user interface of the application. This includes creating wireframes, prototypes, and database schemas.

Development: Write the actual code for the application. Developers use programming languages and tools to create the software.

Testing: Conduct thorough testing to identify and fix bugs to ensure the application works as expected and meets the requirements.

Deployment: Deploy the application to production servers or app stores, making it available to users.

Maintenance and Support: Provide ongoing maintenance, updates, and user support to keep the application running smoothly.

Documentation: Create user manuals, technical documentation, and training materials.

Training: Train end-users and administrators on how to use the application effectively.

Feedback and Iteration: Collect user feedback and make iterative improvements to the application based on user input.

Security and Compliance: Ensure the application complies with security and privacy standards and regulations.

Scalability and Performance Optimization: Optimize the application's performance and scalability for growth.

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Backup and Disaster Recovery: Implement backup and recovery strategies to safeguard data and ensure business continuity.

Monitoring and Analytics: Set up monitoring tools to track the application's performance and gather analytics for insights.

Sustainability and Future Planning: Plan for the long-term sustainability of the application, considering updates, upgrades, and evolving technology.

Interoperability: Ensure the application can work with other systems and platforms, including legacy systems.

Cost Management: Manage the project costs effectively, keeping them within the allocated budget.

Globalization: If the application has a global audience, address localization, internationalization, and language support.

Ethical Considerations: Address ethical concerns about data usage, artificial intelligence, and societal impact.

Regulatory Compliance: Ensure ongoing compliance with evolving data protection, privacy, and legal regulations.

By following this structured approach, you can ensure that the ICT-based application is well-planned, well-executed, and effectively meets the needs of its users and stakeholders.

After identifying the challenges of ICT-based application development and the recommended approach for development, the last aspect to be considered is the application development principles. Here are some principles for developing ICT (Information and Communication Technology) based applications:

User-Centric Approach: Begin with deeply understanding your target users' needs and preferences. Develop the application with the user in mind to ensure usability and satisfaction.

Simplicity and Intuitiveness: Keep the user interface and interaction simple and intuitive. Users should be able to easily navigate the application and understand its functionality without extensive training.

Scalability: Design the application to accommodate growth. It should handle increased data, users, and feature additions without significant redesign.

Security: Prioritize the security of data and transactions. Implement encryption, authentication, and authorization mechanisms to protect user information.

Interoperability: Ensure the application can work seamlessly with other systems and platforms. This is particularly important for enterprise and B2B applications.

Responsive Design: Create a design that adapts to different screen sizes and devices. A responsive design ensures a consistent user experience across various platforms.

Performance Optimization: Optimize the application's performance to minimize loading times and provide a smooth user experience.

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Data Privacy and Compliance: Adhere to data privacy regulations and compliance standards, such as GDPR, HIPAA, or industry-specific requirements.

Accessibility: Design the application to be accessible to users with disabilities. Follow accessibility guidelines and provide features like screen readers and keyboard navigation.

Feedback and Iteration: Collect user feedback and continuously iterate on the application to improve its functionality and usability.

Documentation and Training: Provide clear documentation for users and administrators. Training resources should be available for users who need guidance.

Cross-Platform Compatibility: If the application is intended for multiple platforms (web, mobile, desktop), ensure compatibility while respecting platform-specific design and functionality guidelines.

Offline Functionality: Include features that allow users to work offline and sync data when they regain connectivity.

Cloud Integration: If applicable, integrate cloud services for storage, scalability, and data backup.

Testing and Quality Assurance: Implement rigorous testing and quality assurance processes to identify and resolve bugs and issues before the application's release.

User Support and Helpdesk: Offer user support and a helpdesk for promptly addressing user inquiries and issues.

Backup and Disaster Recovery: Implement robust backup and disaster recovery plans to prevent data loss and ensure business continuity.

Cost-Efficiency: Develop and operate the application with cost-efficiency in mind. Consider factors like hosting, maintenance, and licensing.

Sustainability: Consider the long-term sustainability of the application, including maintenance, updates, and continued relevance.

Compliance with Standards: Adhere to industry standards and best practices to ensure the application's quality and reliability.

By following these principles, you can create ICT-based applications that are user-friendly, secure, and capable of meeting evolving needs and challenges.

In summary, certain issues must be considered to create an ICT-based application. The literature review helped the Project team develop ideas on the targeted application’s architecture. Draft examples of the architecture are also presented in the “documents” tab of the decideright.org website. Also, photos taken during the studies were presented in the tab of “Gallery”.

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Determination of measurement and evaluation criteria and parameters

There are different approaches to the assessment of students. The two main ones are formative and summative assessment approaches. These two approaches have emerged as two topics studied in the literature for a long time. The differences between these two approaches are summarised as follows.

Formative and summative assessments are distinct approaches to evaluating student learning and performance. Understanding the differences between them is essential for educators to assess and support students effectively. Here are the key differences between formative and summative assessments:

1. Purpose:

Formative Assessment: The primary purpose of formative assessment is to provide ongoing feedback during learning. It is used to monitor student progress, identify areas of improvement, and adjust instruction.

Summative Assessment: Summative assessment is conducted at the end of a learning period, such as a unit, course, or school year. Its main purpose is to evaluate and summarize what students have learned.

2. Timing:

Formative Assessment: Formative assessments are conducted throughout the learning process. They are continuous and occur during instruction.

Summative Assessment: Summative assessments are typically administered after a specific instructional period.

3. Feedback:

Formative Assessment: Formative assessments provide immediate and specific feedback to students. This feedback is used to guide their learning and make necessary improvements.

Summative Assessment: Summative assessments generally provide feedback after the learning process is complete. The feedback is often in the form of a final grade or evaluation.

4. Frequency:

Formative Assessment: Formative assessments are conducted frequently, often in the form of quizzes, discussions, or activities, to check student understanding.

Summative Assessment: Summative assessments are usually less frequent and may consist of major exams, projects, or end-of-term evaluations.

5. Grading:

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Formative Assessment: Grading in formative assessments is often less formal and may be focused on participation, effort, or progress rather than final results.

Summative Assessment: Summative assessments have a more structured grading system, and the results contribute significantly to a student's final grade.

6. Use of Results:

Formative Assessment: The results of formative assessments are used by teachers and students to inform instruction and adapt teaching methods to address learning gaps.

Summative Assessment: Summative assessment results are typically used for accountability, reporting, and making decisions about students' progress or readiness to advance.

7. Examples:

Formative Assessment: Examples of formative assessment include class discussions, quizzes, homework assignments, and peer reviews.

Summative Assessment: Examples of summative assessment include final exams, standardized tests, end-of-term projects, and comprehensive evaluations.

8. Stakes:

Formative Assessment: The stakes in formative assessments are generally lower, emphasizing learning and improvement rather than high-stakes outcomes.

Summative Assessment: Summative assessments often have higher stakes, as they are used for final grading and may impact students' progression or graduation.

Understanding when and how to use formative and summative assessments is essential for effective teaching and learning. Both types of assessments play important roles in the educational process, and a balanced approach is typically the most effective way to support student growth and achievement.

In addition to evaluation, teaching methods is another critical issue to consider. Teaching methods have a profound influence on student performance and learning outcomes. Educators employ various instructional strategies to convey information, engage students, and promote understanding of the subject matter. The choice of teaching methods can significantly affect how well students grasp and retain knowledge. Here are some key insights into the impact of teaching methods on student performance:

Active Learning: Active learning approaches, such as group discussions, problem-solving activities, and hands-on projects, encourage student engagement and foster a deeper understanding of the material.

Lecture-Based Instruction: Lecture-based instruction is effective for conveying information but may require additional interactive elements to ensure student comprehension and retention.

Experiential Learning: Learning through real-world experiences and practical applications can enhance students' ability to apply their knowledge, positively impacting performance.

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Blended Learning: Combining in-person instruction with online resources and technology can offer students flexibility and access to a variety of learning tools.

Differentiated Instruction: Tailoring instruction to accommodate diverse learning styles and abilities can help students perform better, as it addresses individual needs.

Technology Integration: The incorporation of technology, such as educational apps, simulations, and online resources, can make learning more engaging and interactive, contributing to improved performance.

Problem-Based Learning: Problem-based learning methods encourage critical thinking and problem-solving skills, leading to better academic performance.

Peer Teaching: Collaborative learning and peer teaching can enhance student performance as they learn from one another and work together to solve problems.

Flipped Classroom: Flipped classroom models, where students learn content independently before class and engage in discussions and activities during class, can lead to better comprehension and knowledge retention.

Socratic Method: The Socratic method involves asking open-ended questions to stimulate critical thinking and active participation, improving students' ability to analyze and understand complex topics.

Inquiry-Based Learning: Encouraging students to ask questions and explore topics independently can boost their curiosity and overall performance.

Mentoring and Coaching: Individualized guidance and mentoring from educators can help students set goals, receive feedback, and achieve better results.

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Inclusivity and Accessibility: Creating an inclusive learning environment that accommodates diverse needs, including those of students with disabilities, positively impacts student performance.

Cultural Sensitivity: Teaching methods considering cultural diversity and sensitivity can foster a more inclusive environment where all students can excel academically.

Effective teaching methods are essential for promoting student success and academic achievement. Educators need to adapt and diversify their instructional approaches to cater to various learning styles and ensure that students absorb information and apply it effectively.

Assessment or teaching methods are not the only factors in the decision-making process for teachers. Different factors also come into play, which is also shown in the needs analysis. Classroom size, teachers' backgrounds, competencies in using technology, and educational experience might be considered key points as factors.

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The link between data-driven decision-making and student assessment is tight. To understand the relationship between these two concepts, it is necessary to understand the enabling factors. A summary of the literature is presented below.

Data-driven decision-making (DDDM) and student assessment are closely related in education. DDDM is the practice of using data to inform and guide decisions in educational settings, and student assessment is a critical source of data in this process. Here's an overview of the relationship between DDDM and student assessment:

Data Collection: Student assessment is a fundamental data source in the education system. It evaluates students' knowledge, skills, and performance in various subjects and areas. This data can be collected through formative assessments (ongoing assessments during instruction) and summative assessments (evaluations at the end of a learning period).

Data Analysis: DDDM requires systematic data analysis to identify trends, patterns, and areas of improvement. When it comes to student assessment, this means analyzing the results of assessments to understand how well students are performing and where they may need additional support.

Informed Decision-Making: The data collected from student assessments can inform a wide range of decisions in education. Educators and administrators can use this data to make curriculum adjustments, instructional methods, student support, and resource allocation decisions.

Individualized Learning: Student assessment data can also tailor instruction to individual student needs. By analyzing assessment results, educators can identify which students may require additional help or more challenging material, allowing for a more personalized learning experience.

Accountability: Data-driven decision-making in education often involves accountability measures. Student assessment results are used to assess the effectiveness of schools, teachers, and educational programs. This information can lead to changes and improvements in the education system.

Continuous Improvement: DDDM promotes a cycle of continuous improvement in education. Student assessment data is a critical component of this cycle, as it helps educators and institutions identify areas where changes are needed and track the impact of those changes over time.

Evidence-Based Practices: DDDM encourages the use of evidence-based practices in education. Student assessment data provides evidence of what is working and needs adjustment, helping educators make informed choices about instructional strategies and interventions.

Data Quality: The data collected through student assessments must be high quality, reliable, and valid. Educators and institutions must ensure that the assessments used are aligned with learning objectives and provide meaningful data for decision-making.

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In summary, data-driven decision-making and student assessment are intertwined in education. The data derived from student assessments play a central role in informing decisions that impact teaching, learning, and overall educational quality. Data analysis and utilization can improve student outcomes and more efficient educational systems.

There are different approaches to the assessment of students. The two main ones are formative and summative assessment approaches. These two approaches have emerged as two topics studied in the literature for a long time. The differences between these two approaches are summarised as follows.

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In summary, data-driven decision-making and student assessment are intertwined in education. The data derived from student assessments play a central role in informing decisions that impact teaching, learning, and overall educational quality. Data analysis and utilization can improve student outcomes and more efficient educational systems.

At this point, the project team focused on quickly recording the data obtained through in-class experiments and observations rather than evaluating the students by bringing together the information provided by the scanned literature and the examples provided by the European partners from their own countries and European examples in general. While the needs analysis pointed out that teachers' problems with student observations were more limited, it pointed out that the bigger problem was in recording the results of the observations, turning them into information on a regular basis, and presenting them to the teacher.

When all these come together, it has been decided that it is more important to develop an application that will facilitate the registration process of teachers who have no problem following the curriculum, rather than a tool that will help students directly observe the selected curriculum-based achievements.

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Evaluation and Revision

The data collected through interviews and surveys with teachers in the field are summarized and presented above. The same data was presented to European partners in meetings held before the trainings in the Netherlands and Finland. Within the scope of these presentations, we had the opportunity to consult on the framework of the topics to be focused on in the trainings. The draft contents developed in this context were discussed among the partners and concluded (Annex 1 and Annex 2).

The features of the application, which will be developed as a result of needs analysis, training, and consultations, have been revised for students and teachers. In this context, various examples have been developed on the final version and presentation of the content that should be taken into consideration in the application development principles and design process. The link to these examples is provided above.

As a result of the meetings held with computer software experts, the issues that need to be taken into consideration so that the application to be developed can be used universally and effectively by people with different competencies have been underlined.

The development process of the application within the full context has begun.

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Summary

The project focuses on developing a phone application that can help teachers make data-based decision-making mechanisms they need to make their work in the classroom more effective and to produce effective results based on their choices or decisions as a result of their decisions. Needs analysis was used to increase the compatibility of the application to be developed with teachers in the field. The needs analysis of teachers focused on identifying their needs for learning the use of technology and the necessary information that forms the basis for the decision-making process. The application to be developed in the following process must serve a wide segment of the target audience, teachers from different education, experience, and age groups. For this reason, one of the first things done in the study was to focus on the principles of application development, and the issues that need to be taken into consideration were determined based on the literature. Then, in order to determine the achievements that will be included in the application, the European and Turkish curricula were compared, and the achievements that were reflected in the basic courses and in common were brought to the fore. In addition, the recommendations of experts from Hacettepe University and Gazi University, who decided on the suitability of evidence-based teaching methods for the outcomes to be taught, were also clarified to be incorporated into the application. In the following step, another dimension of the application was clarified by taking into account the points on the evaluation criteria and issues included in the training of European partners.

Thus, the registration process of teachers in practice and the structure of the content that will enable them to be informed regularly were revealed. In the interviews with PİKOMTEK's experts, who developed the application, it was decided that embedding the content to be developed to support teachers' decision-making and learning processes within the application is more advantageous for teachers than the approach of constantly obtaining resources from elsewhere.

After this decision was taken, the development phase of the application started.

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Appendices

Annex 1

Draft 1st_05.26.2021

TRAINING DETAILS/EXPECTATIONS	
EFU	**WU**
Title: Monitoring and Evaluation in Schools	**Title**: Developing School Environment
Goal: The participants understand how to evaluate stakeholders' performance in schools.	**Goal**: The participants understand how to develop a school environment
Obj 1: The participants develop students' performance evaluation tools (control lists, interviews, observation materials etc).	**Obj 1**: The participants learn how to collect data in the schools in order to improve the school environment.
Obj 2. The participants develop teacher performance evaluation tools.	**Obj 2**. The participants learn how to develop support systems based on data-driven decision making.
Obj 3. The participants develop school administrators' evaluation tools.	**Obj 3**. The participants learn about teaching standards for teachers
Brief description of the Training: The training will be set in a workshop format to develop the skills of the trainees. The trainees will extend their knowledge and skills by creating evaluation tools to use in the classroom/schools to make educational decisions.	**Brief description of the Training**: The training will be set to inform the trainees by modeling a supportive learning environment for all. The training will help to understand how to improve the school environment by using data gathered by monitoring effectively.
Notes/Recommendations:	**Notes/Recommendations**:

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Annex 2

Brief Description of the Trainings

Staff Training I-Finland

The meeting will take place in Finland for 3 days. The purpose of this training is to extend the understanding of attendees in student evaluation in schools/classrooms and data-driven decision-making in educational planning in inclusive environments. So, the project partners may ground common understanding about the developing educational plans for the students with needs.

The training will have three main focuses. The first focus is how to evaluate the student's performance in the classroom. The second focus of the training is how to evaluate a teacher's performance in the classroom. The last focus will be on how to make educational decisions based on collected data about the students.

Staff Training II-The Netherlands

The meeting will be held in the Netherlands for 3 days. The purpose of this training is to extend the understanding of the attendees in developing school support systems for everyone in the schools. So, common understanding about how to develop a learning and development environment by using the data coming from the classroom evaluations.

The training will focus on how to create a learning environment that supports students' development and learning by developing individualized learning plans. The second focus will be on how to evaluate learning environments from the perspective of multi-tiered support systems. The last focus will be developing support for the teachers in decision-making about the student's individual educational plans.

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