DigiVillage Chronicles: A Serious Game Designed to Improve Digital Skills for Accessing Public Services

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Abstract: Smart villages have transformed rural areas by using innovative solutions to provide improved public services. However, citizens often struggle to access these services due to a lack of digital skills. To address this issue, we present *DigiVillage Chronicles*, a serious game designed for young adults aged 18 to 35 to enhance their digital skills to access public services in smart villages. The game is set in a fictional smart village where the player participates in digital activities related to public services and gains insight into navigating the platforms offering these services in real life. The activities include browsing and applying for jobs, transferring money online, and booking a doctor's appointment. In this paper, we present a proof of concept for the game and evaluate its quality using criteria related to both the serious and game components, as well as the balance between these elements.

1 INTRODUCTION

Digitalization has greatly changed our society by enabling access to various commercial and public services via online platforms, particularly on mobile devices (Olsson et al., 2019). The transition towards digital services has expanded beyond urban areas, with rural communities implementing *smart village* initiatives that utilize technology and innovation to improve access to essential services, promote sustainable development, and strengthen local economies (Adamowicz and Zwolińska-Ligaj, 2020; Zavratnik et al., 2018). Smart villages are rural communities that use innovative solutions to enhance resilience, quality of life, and development opportunities in economic, social, health, and communication sectors (European Commission, 2017; Komorowski and Stanny, 2020). These villages aim to bridge the gap between rural and urban communities by integrating smart technologies, infrastructure, and services to support agricultural and non-agricultural sectors (Bokun and Nazarko, 2023). Smart villages focus on the specific challenges and opportunities faced in rural areas, leading to distinct implementation strategies that differ from those used in urban settings (Komorowski and Stanny, 2020).

A considerable challenge for smart villages is achieving the digital transformation of local government operations, which involves using innovative and smart solutions to deliver public services (Satoła and Milewska, 2022). In this context, the digital divide becomes a major obstacle, particularly in rural areas (Esteban-Navarro et al., 2020): e-government initiatives may fail to engage citizens if they do not possess the necessary skills (Yu et al., 2017; Sundberg, 2019).

The Digital Competence Framework for Citizens, commonly called DigComp, helps policymakers develop policies and plan educational and training initiatives to enhance the digital skills of various target groups (Vuorikari et al., 2016). While existing studies primarily focus on education (Fernández-Batanero et al., 2022; Spante et al., 2018), information literacy (Grabowsky and Weisbrod, 2020), and communication (Van Laar et al., 2017), there has been less emphasis on e-government.

To address this issue, in this paper, we propose *DigiVillage Chronicles*, a serious game designed to enhance the acquisition of digital skills to access digital public services.

The paper is organized as follows: Section 2 provides background information and related work. Section 3 describes the serious game. Section 4 describes the evaluation of the game, and Section 5 concludes the paper and outlines ideas for future work.

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2 RELATED WORK

Clark C. Abt (Abt, 1987) popularized the term "serious games", which are defined as games "in which education, in its various forms, is the primary goal rather than entertainment" (Michael and Chen, 2005). Serious games provide an interactive and effective method for transferring knowledge and promoting learning or behavior change outcomes (Connolly et al., 2012). Unlike traditional video games, they focus on problem-solving and learning while utilizing similar media and interactive elements as recreational games, making them engaging and enjoyable. They are designed to facilitate learning, skill development, and behavior change by following a game design process that prioritizes achieving educational goals through gameplay (Bergeron, 2005).

Based on the constructive learning theory, serious games create learning environments where participants can address real problems, explore various solutions, learn from their mistakes, and gain new insights without the fear of real-world consequences (Deterding et al., 2011). For this reason, they are used across diverse fields, such as healthcare (Maheu-Cadotte et al., 2018), education (Deshpande and Huang, 2011; Rajaravivarma, 2005; Schäfer et al., 2013), military (Johnson et al., 2000), and language teaching (Zou et al., 2021; Hung et al., 2018). Hanna Wirman (Wirman et al., 2018) explored and categorized serious games into fourteen domains based on themes and learning goals and discussed games related to Hong Kong public services, including building maintenance, postal services, and tunnel systems.

The use of serious games to engage citizens in public service processes has been explored in various studies. For instance, Pflanzl et al. proposed a serious game aimed at helping citizens understand the retirement process in Brazil (Pflanzl et al., 2017). While they outlined potential stages of game design, their proposal remained theoretical. Moreira de Classe et al. investigated how serious games could improve citizens' understanding of service delivery through a game called Play Your Process (PYP). This game was designed for three different public service scenarios in Brazil and demonstrated positive outcomes (De Classe et al., 2021). Hassan L. provided a theoretical framework and guidelines for implementing gamification on platforms designed for civic engagement (Hassan, 2017).

Serious games have also been used to engage citizens in wider civic initiatives. For example, Poplin A. proposed a game to encourage citizens to share their opinions about a marketplace and gain insights into the city's existing conditions and challenges (Poplin, 2011). Aguilar et al. presented a city simulator game to facilitate collective decision-making and to promote citizens' electronic participation (Aguilar et al., 2019).

The aforementioned research uses serious games to promote citizens' understanding of public processes and encourage participation. They do not primarily focus on designing serious games to access digital public services and enhance citizens' digital skills.

3 THE SERIOUS GAME

In this paper, we present *DigiVillage Chronicles*, a serious game aimed at helping citizens of smart villages designed to assist citizens of smart villages in developing essential skills for accessing digital public services. The splash screen of the serious game is shown in Figure 1).

Figure 1: *DigiVillage* splash screen.

DigiVillage Chronicles targets young adults aged 18 to 35, particularly those in rural areas having limited familiarity with digital public services. However, regardless of background, it can benefit anyone looking to improve their understanding. The game is set in a fictional smart village named *DigiVillage*, where the local government's operations have undergone digital transformation. This transformation involves the implementation of innovative and smart solutions to enhance the delivery of public services.

As shown in Table 1, to demonstrate the serious game as a proof of concept, we included three services identified as essential or important in the European Union Access Factsheet (European Union, 2022). In each service, we selected one activity, such as browsing and applying for jobs from youth services, transferring money online from bank services, and booking a doctor's appointment online from health services. The player controls the protago-

nist, who will engage in activities that reflect real-life interactions with digital public services.

Table 1: Services and activities included in the proof of concept of the serious game.

Service	Activity
Youth services	Browsing and applying for jobs
Bank services	Money transfer
Health services	Booking a doctor's appointment

3.1 The Story Telling

Once known for its vineyards and rolling hills, DigiVillage has evolved into a smart village that offers digital access to all public services, along with a *Digital Competence Center* that assists residents in learning about digital services. Figure 2 shows the map of DigiVillage and its services, highlighting the services and activities listed in Table in Table 1.

The main character, John, lives in DigiVillage and appreciates the convenience of living in a digital world, but he is still acquiring the necessary skills. In the game, the player controls John as he faces various digital challenges in his daily life. The proof of concept includes the following three scenarios, each centered around a digital activity.

Scenario 1. Searching for Job Openings Online. John is on his way to meet his friend Anna (Figure 3), who recently started a new job and invited John to celebrate together. John congratulates Anna and shares that he is currently job hunting. He mentions that he has visited several companies to submit his CV but has not yet found the right fit. Anna tells him about the Digital Competence Center in town, where she received valuable guidance on browsing and applying for jobs online. Grateful for the tip, John heads to the Digital Competence Center. A staff member introduces him to the platform and shows how it can help him learn essential digital skills, including a step-by-step guide to online job searching. Eager to start, John learns about online job search. After completing the search and application process for a job, John gets a digital badge.

Scenario 2. Making an Online Money Transfer. One day, John receives a call from his friend Mark, who asks him to transfer some money urgently. John heads to the bank but finds it closed. When John calls Mark to explain the situation, Mark advises him to send the money online (Figure 4). John figured out he could learn to send money online from the Digital Competence Center. After completing the online bank transfer activity, Mark calls John to inform him that he received the money. John gets a digital badge for successfully learning about online banking.

Scenario 3. Booking a Doctor Appointment Online. John's mother texts him, saying she made his favorite dish and invited him to visit. During lunch, she asks him to go to the clinic and book an appointment with the doctor for her (Figure 5). John says that it could be done online. She is curious to learn how, and John shows her the Digital Competence Center. After completing the activity of booking a doctor's appointment, his mother thanks him. John gets a digital badge for successfully learning about online health services.

3.2 Game Mechanics

Each of the three scenarios in the game focuses on a challenge that requires understanding and accessing a specific digital public service. As the player navigates the village, they interact with various characters, setting the stage for a digital challenge.

The Digital Competence Center provides support by offering an informative quiz and a step-by-step guide to complete the challenge. The quiz consists of four multiple-choice questions. The player earns one point for each correct response and receives feedback for incorrect responses. To pass the quiz, the player must score at least 3 out of 4 points and can retake the quiz as many times as necessary to achieve this score. When the player passes the quiz, the activity is unlocked, and the player must follow certain steps correctly to complete the activity.

For example, in Scenario 3, for booking a doctor appointment online, the main character completes a quiz (shown in Figure 6) to gain essential knowledge about the service and the required information for accessing it. After completing the quiz, he performs the activity (shown in Figure 7) where he follows specific steps, such as logging into the website using his health card number, selecting the date and time, and finally confirming the appointment.

4 EVALUATION

We used criteria for high-quality serious games based on the framework proposed in (Caserman et al., 2020) to evaluate the proposed game.

These evaluation criteria consider the aspects associated with serious and game parts along with the balance between these elements. The core elements of the *serious part* include the presence of a characterizing goal, the creation of suitable methods for accomplishing these goals, and the assessment of the game's quality. he core elements of the *game part* include suitable game design and appropriate media

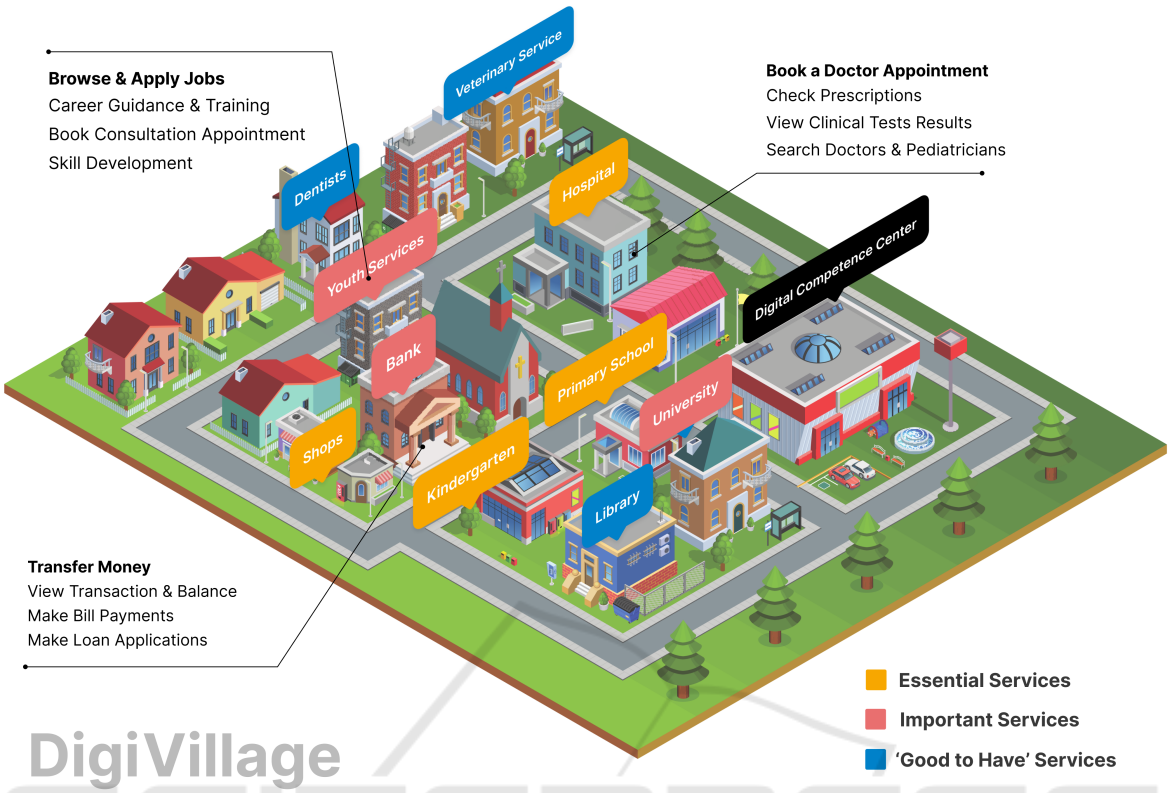

Figure 2: Map of DigiVillage. The legend categorizes services as essential, important, and good-to-have according to the European Union Access Factsheet (European Union, 2022).

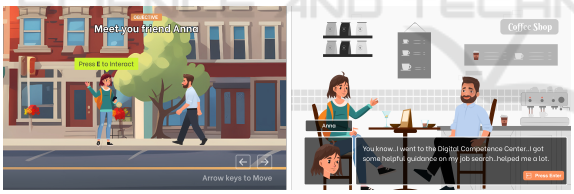

Figure 3: In Scenario 1, the main character, John, interacts with his friend, Anna, who tells him about the Digital Competence Center in town.

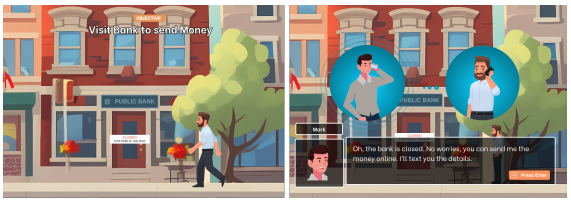

Figure 4: In Scenario 2, the main character, John, interacts with his friend Mark, who advises him to make an online money transfer.

presentation. The *criteria for balance between the serious and game part* evaluate how well these two components are integrated and interconnected.

Figure 5: In Scenario 3, the main character, John, interacts with his mother, who needs to book a doctor's appointment.

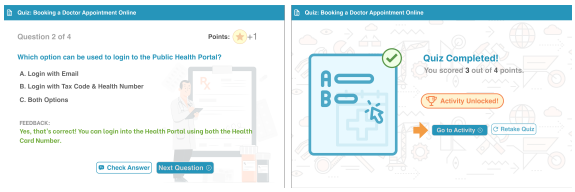

Figure 6: The informative quiz regarding doctor appointments can be found in Scenario 3.

Table 2 details how the proposed game, *DigiVillage Chronicles*, has been designed to fulfill each of these criteria, ensuring that it qualifies as a high-quality serious game.

Table 2: Evaluation of the game with the quality criteria for serious games proposed by (Caserman et al., 2020).

Sections of Quality Criteria	Core Elements	How *DigiVillage Chronicles* fulfills the criterion
Serious Part	Goal	The game aims to improve digital literacy by teaching essential skills for accessing public services, focusing on real-world applications to ensure that the skills learned during the game are transferable. The game provides the player with clear step-by-step instructions and visual hints to achieve the goal during the activity. The quiz delivers essential foundational knowledge on accessing public services and is an unavoidable step to unlock the corresponding activity.
	Method	The game provides appropriate feedback for responses in the quiz and unlocks the activity after the player scores specific points. The game offers positive reinforcement through digital badges upon completing each activity. The game includes activities that mimic real-life scenarios the target group faces in accessing public services.
	Quality	The player performs certain steps to complete specific activities. Upon completing an activity successfully, they receive a badge, demonstrating their learning progress and ability to navigate digital platforms.
Game Part	Enjoyment	The game provides the player with new challenges and rewards with points and badges, which keeps the player engaged. The game provides variety in gameplay through different user interface (UI) elements in each activity, such as filters, search bars, text inputs, and radio buttons. The game invokes a sense of accomplishment and satisfaction when other characters are grateful to the protagonist for helping them. While exploring Digivillage, the player can enter specific buildings and notice small environmental details like falling leaves and cars passing by, all of which add a feeling of immersion in the game world.
	Media Presentation	Vibrant images, approachable characters, and friendly dialogues create a welcoming experience. Visual hints and step-by-step guidance during activities improve interactivity and player support. The game also features engaging background music and sound effects for events, such as correct or incorrect quiz responses and badge achievement.
Balance	Integrated serious part with gameplay	The activities are directly related to the digital challenges occurring during the interaction with non-playable characters (NPCs) from the game environment. An interdisciplinary team of game designers and domain experts worked together to build the scientific foundation of the game.
	Interaction technology	Activities in the game are created from examples of several public service websites. Activities mimic real-world digital portals with forms, input fields, clickable buttons, and checkboxes, ensuring a seamless transition from the game to actual applications. The game involves intuitive game controls, such as a left mouse click to move the player and a right mouse click to interact with objects and characters in the game.

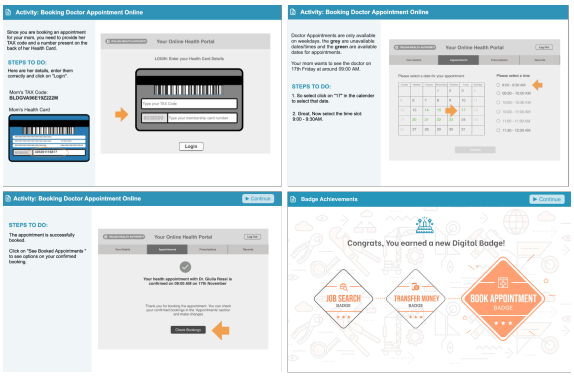

Figure 7: The activity to book a doctor's appointment included in Scenario 3.

5 CONCLUSION AND FUTURE WORK

This paper presents the proof of concept of a serious game that aims to educate citizens about accessing digital public services using story scenarios centered around a digital challenge. The evaluation of this game, based on the quality criteria for serious games (Caserman et al., 2020) shows that the strong point of the game lies in its integration of serious part with the gameplay by incorporating activities around a digital challenge arising from the story scenario and character interactions. Also, the interactive gameplay provides an engaging and satisfying experience with elements like points and badges that can enhance the player's motivation. However, to ensure a better flow in the game, the difficulty of the game could dynamically adapt to the player's performance. Moreover, the social interaction aspect could be improved by introducing a multiplayer mode in which players would work together and collaborate to accomplish the game's challenges.

The game combines educational goals with interactive gameplay, meeting the quality standards for serious games while balancing educational content and gaming elements. However, user evaluation is necessary to assess the game's effectiveness regarding learning outcomes and to improve the gameplay experience based on user feedback. Therefore, our future work will focus on testing and evaluating the game's effectiveness through pre and post-surveys.

To show the potential of the game concept, the proof of concept presented in this paper includes three digital activities, each selected from a distinct digital public service. Future efforts will focus on evaluating the game's effectiveness and incorporating more activities on a broader variety of public services. Furthermore, the game could introduce new mechanics, such as allowing players to assist other characters who encounter similar challenges related to digital skills. This would reward players with social points and enhance the protagonist's social status within DigiVillage, reinforcing their learning by applying the concepts experienced during gameplay. Future developments may also include a multiplayer aspect, where players join various digital villages as virtual citizens and collaboratively work towards goals to increase the digital literacy of their village.

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