

Article

The Concept of Learning Cities: Supporting Lifelong Learning through the Use of Smart Tools

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Abstract: This paper presents an initiative in which QR codes on public transport are used to provide citizens with books that they can read and that will improve their general knowledge. It builds on the concept of the learning city and combines it with smart city tools. This paper aims to use a descriptive–empirical approach, including an experiment in Bucharest. This research aims to contribute to the academic world, urban sociology, public administration, and lifelong learning education.

Keywords: urban sociology; QR code; smart city

1. Introduction

We initiated this study with the aim of assessing the concept of learning cities, a specific topic in urban sociology, and its potential application in creating a smart and sustainable society. The objective is to use smart tools in public places to educate citizens and help them gain lifelong learning knowledge. To achieve this, we came up with an initiative involving the use of QR codes on public transport in Bucharest, allowing citizens to read two different books and thereby improving their general knowledge and providing opportunities for leisure and educational activities. This article is based on extensive research on the concept of the learning city, with compelling case studies and implementation ideas that have produced encouraging results. Combining this concept with smart city tools is an approach that has recently gained momentum. Therefore, previous works can be considered, analyzed, and criticized.

To check the practicability of the objective of this paper, we conducted an experiment on Bucharest’s public transport in collaboration with public organizations which oversaw and provided access to the transportation system, such as the Bucharest Transport Society (STB) and Metrorex S.A. We offered the target group two QR codes that, when scanned, led to two free e-books. The experiment’s objective was to facilitate access to literature and assess the effectiveness of our proposed initiative. Following the end of the experiment, we collected data and provided an analysis of the results.

Through this initiative, we seek to provide knowledge to citizens, who access it by scanning QR codes, offering them options and possibilities in terms of recreational and educational activities. This paper aims to use a descriptive–empirical approach, formulating observations and conclusions based on the collected data and empirically analyzing theoretical models from the chosen field.

Based on the experiment in which access to a digital library was facilitated using QR codes on public transport, there are two hypotheses that can be proposed. The first hypothesis is that providing access to literature in a public space through digital means will increase the number of people engaging in reading and education. This can be measured by tracking the number of times the QR codes were scanned and how many people accessed the digital library. The second hypothesis is that this initiative can generate a positive reaction on social media and enhance the image of the public transport company. This



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can be measured by monitoring social media platforms for any feedback, comments, or reactions related to the initiative. By testing these hypotheses, we can evaluate the potential impact of using smart city tools to promote learning and education in public spaces.

The experiment and the analysis performed in this article contribute to the academic world, urban sociology, public administration, and lifelong learning education. Overall, this paper highlights the importance of utilizing technological tools and innovative initiatives to enhance citizens' access to knowledge and promote smart and sustainable urban development.

In our research, we have used QR codes as a tool to provide readers with access to e-books. According to the Oxford English Dictionary, a QR code is a machine-readable code consisting of an array of black and white squares which is generally used for storing URLs or other information that can be scanned using a smartphone camera. By integrating this tool into the public transport system in Bucharest, we were able to provide citizens with an easy and fast way to access books and broaden their knowledge base. This initiative not only provides a unique and exciting way for people to engage with literature, but it also demonstrates how the incorporation of smart technology into public spaces can lead to positive outcomes.

While smart cities and learning cities offer many potential benefits, these concepts have been separated historically. By bridging this gap and connecting their objectives, we can see the codependency between lifelong learning and technology, which can ultimately enhance our overall quality of life. Learning cities are characterized by communication, interaction, and learning within the community, while smart cities rely on advanced technology, infrastructure, and organizational systems. By examining the codependency between these two initiatives from the perspective of a learning society, we can identify key features that can lead to lifelong learning and further advances in technology. This exploration helps redefine the concept of a learning society in the modern age and promotes the development of smart cities and sustainable cities. Our study uses QR codes as a smart tool to facilitate knowledge acquisition and illustrates the potential of using technology to improve learning and access to resources [1].

We selected two e-books, namely *The Alchemist* and *In Search of Lost Time*, both of which are Romanian versions of novels. Our decision to use these literary works was not driven by any functional consideration; rather, we intended to pleasantly surprise our curious readers and provide them with engaging reading material during their travels on Bucharest's public transportation system.

2. Conceptual Background

We believe that Lifelong learning is the safest path to accessible opportunities, improving living conditions, and increasing financial wellbeing and income per capita, ultimately ensuring sustainable human development. The United Nations' specialized agency for education, UNESCO, supports the right to lifelong learning and conducts its operations in accordance with Sustainable Development Goal 4 [2].

The idea of "learning cities" is one of the tools we can use to achieve Sustainable Development Goal (SDG) 4, "Quality Education", whose aim is to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [3]. The concepts "learning society" and "lifelong learning" were first introduced in 1970 and 1980, respectively, with the goal of developing societies impacted by the effects of the post-industrial transition [4]. In an era of widespread social transition, where education is crucial, sustainable human development is an ideal for which we seek on a worldwide scale. Organizations are able to act creatively and efficiently during times of change once people have the essential skills and capabilities [5].

The concept of smart cities reflects the use of smart technology tools to make cities more sustainable. In terms of types of approach, we can consider two types of initiative: top-down and bottom-up. While top-down refers to large-scale projects with financial contributions, bottom-up refers to activities that put citizens at the center and identify

solutions to the problems they face [6]. The smart city concept utilizes information and communication technologies and the Internet of Things to automatically collect and process environmental data for the efficient management of urban areas and resources, with telecommunication technologies playing a critical role in providing the necessary connectivity, and multiple cities worldwide have embraced this approach to improve citizens' quality of life, energy efficiency, governance, and emissions reduction [7]. Thus, smart city initiatives not only include those large projects that involve many stakeholders and advanced technologies, but also those that involve basic technologies and maintain the goal of increasing sustainability. In this respect, we can look at the example of the Brazilian city of Rio de Janeiro, where a group of young people used mobile technology equipped with cameras and attached to kites to capture piles of rubbish in poor communities, as well as sizing and mapping accident-prone areas [8]. Therefore, the approach we want to pursue in this paper is bottom-up. We want to combine the concept of learning cities, i.e., cities that offer opportunities to gain knowledge in public spaces, with the concept of smart cities that aim to create sustainable cities through the use of smart technologies. The two features of the learning city concept that are the most relevant to this paper are as follows: it is both ambitious and achievable, i.e., it represents significant progress while remaining realistic, and it is clear and accessible to all involved, making sense to ordinary people [9].

On the one hand, there has been recent debate concerning smart cities in which the importance of learning has been emphasized. This debate has resulted in a call for smart education, which supports lifelong development, equity and inclusivity, responsiveness to environmental protection and climate change, the use of data and data science, and blended delivery methods with the aim of increasing access, collaboration, and reduction in environmental pollution. Current forms of education have been criticized for their various shortcomings, such as teacher-centered learning, limited learning spaces, limited choice of content, and restricted paces of learning. Modern/future education should be compatible with the knowledge and technological advances needed in smart cities [10].

Citizen perceptions of urban innovation, especially in the context of smart cities, have become increasingly important in recent years. Diffusion theory and innovation diffusion theory provide models to explain the social and technological factors that influence the uptake and sustained use of innovative technologies, while empirical evidence, including political participation, ICT use, and socioeconomic factors, can be used to analyze the determinants of citizen participation in smart city initiatives [11].

On the other hand, rapid advancements in technology along with its integration into urban life have brought about a need for citizens to continuously learn and adapt. As a result, the concept of lifelong learning has gained significant attention as a tool for the development of smart cities. The result has been an increased focus on education and training programs, as well as the incorporation of technology-enhanced learning methods to promote citizen learning and engagement in the development of smart cities [12]. Nowadays, urban areas offer favorable conditions to ensure that all citizens have access to educational opportunities throughout their lives, e.g., high population density and complex infrastructure, and the consolidation and expansion of these opportunities are the focus of our approach to the learning city [13]. The global phenomenon of urbanization and the development of smart cities create an environment suitable for educating all citizens in the public space, ensuring access to education outside the formal environment of the classroom. The UNESCO Institute for Lifelong Learning (UIL) defines the concept of the learning city as "a city which effectively mobilizes its resources in every sector to promote inclusive learning from basic to higher education; revitalize learning in families and communities; facilitate learning for and in the workplace; extend the use of modern learning technologies, enhance quality and excellence in learning; and nurture a culture of learning throughout life" [14].

Learning cities can confer significant benefits upon their inhabitants, including bolstered economic competitiveness, elevated social harmony, enhanced cultural sensitivity, improved environmental sustainability, and better overall health outcomes. A learning

city can achieve these outcomes by providing people with easily accessible and diverse educational opportunities, ranging from vocational training and community workshops to adult education programs. Such initiatives equip individuals with the knowledge and skills necessary for thriving in today's fast-paced and ever-changing world. Moreover, a learning city can cultivate a sense of belonging among its diverse residents, promoting social inclusion and mitigating inequalities. Additionally, such a city can foster healthy lifestyles and provide opportunities for physical activity, leading to improved health and wellness for its inhabitants. Moreover, a learning city provides opportunities to display and revel in its cultural inheritance. This leads to the development of a platform for promoting cultural exchange and understanding between diverse groups. Lastly, with its emphasis on sustainable practices and environmental awareness, a learning city can foster a sustainable future for all [15].

Lifelong learning provides more than just the capacity to continue the educational process begun in school; rather, it involves making connections between learning and all aspects of daily life, including employment, the family, civic engagement, and personal growth [16]. As a result, there are several ways in which formal, non-formal, and informal education environments are perceived. Consider the following examples: the Espoo Library bus for children in Finland, citizens developing their literacy skills by writing on the ground in Taoranting Park in China [17], and senior citizens painting Portugal's city walls with graffiti art [18]. These are all examples of good practice when it comes to designing and implementing learning cities.

As in the examples mentioned above, our chosen territory is suitable for an informal way of educating people, subverting expectations of places in which knowledge can be gained. The target group can include individuals of various ages, genders, and/or nationalities and can use different tools to support a society that promotes education for all its members, whoever or wherever they may be (conventional, smart, innovative, reused etc.). The main point is to make education accessible for individuals of all ages, genders, and nationalities, and thereby create a sustainable, skilled, responsible society full of opportunities.

3. Challenges in Developing Smart and Sustainable Learning Cities

For some, social transformations and the evolution of societies have been sources of satisfaction, while for others, they have been reasons for frustration. Changes frequently produce disagreements since they are often unable to meet everyone's needs. During the SARS-CoV-2 pandemic, for example, while the administrative, economic, social, and educational fields had difficulty adapting to the imposed restrictions (e.g., by conducting professional activities online or implementing social distancing), the technology and information systems sector was able to adapt quickly, whether by reducing the risk of infection, developing means of virus detection, producing vaccines, or providing indispensable tools to support the professional activities of citizens. Therefore, changes produce waves that have an impact on many different areas, challenging them and forcing them to adapt to the requirements of a new phenomenon, process, or product [19]. On the other hand, Tim Campbell emphasizes the notion that successful change management involves collaboration and participation from diverse stakeholders, as well as continuous learning and improvement. By building a culture of innovation and experimentation, cities can become more resilient, inclusive, and sustainable in the face of rapid urbanization and globalization [20].

Governments and city authorities are confronted with the challenge of ensuring the sustainable social, economic, and environmental development of cities while meeting the needs of citizens. In response, new approaches, such as green cities, sustainable cities, zero-carbon cities, and smart cities, are being introduced to revolutionize the use of natural resources and urban infrastructure and to address urbanization and improve the quality of life of citizens [21]. We must not lose sight of the fact that the stability of the three fundamental pillars (economic, social, and environmental) is necessary to ensure

sustainable development. We examined various strategies that have been used by learning cities and analyzed the difficulties these cities experienced in order to strengthen our approach to smart and sustainable learning cities. In the case of Melton, Australia, it was discovered that the education system could not provide an education for all young people due to substantial population growth, so the standard of education was below average and there were also poor employment opportunities [22]. Therefore, in this case, we identify socio-economic challenges.

Regarding Cork, Ireland, issues have been noted concerning the social and environmental pillars. These include, on the one hand, social exclusion, individual isolation [23,24], and the integration of immigrants from Eastern Europe and Africa [25]. Moreover, the rise in flooding incidents has had a negative impact on the city's economy, culture, and health [26]. The implementation of the concept of the learning city is more challenging, and its results are often delayed, due to problems concerning the pillars of sustainable development. It is crucial to remember that the goal of this tool is to improve education rather than establish the perfect society. Thus, it is appropriate for regions that are dealing with various challenges.

Lastly, in Amman, the capital of Jordan, we noticed significant difficulties that this predominantly Arab society has had to face in order to implement the learning cities initiative, including disrespect for the law (which tends to attract skepticism of participation in decision making), inequalities [27], water scarcity, power cuts, a high rate of growth in population and migration, economic problems and unemployment, climate change, inadequate infrastructure and public transportation, and rising traffic congestion [28].

We believe that the learning cities concept can be implemented much more efficiently on a smaller scale because doing so will increase the likelihood of success and allow the chosen territory to easily overcome its challenges. The more disadvantaged and vulnerable a community is, the stronger the need to educate people anytime and anywhere [29] because by encouraging personal growth in each person, society as a whole indirectly grows as well. We take on the responsibility of contributing to the development of the society to which we belong by writing this paper and, moreover by organizing the following experiment.

4. Experiment: Smart Access to Literature on Public Transport in Bucharest

Romania is a European country in the second phase of its demographic transition, a process which is characterized by depopulation of rural areas, rising migration, higher life expectancy, an aging population, and other factors [30]. Bucharest and Ilfov have 2,650,691 registered citizens (9% of the country's population), resulting in a population density of 8771 individuals per km² [31,32]. Despite being a congested metropolis in many respects, it continues to be an economic, professional, and educational magnet. Bucharest is among several other cities in Romania that are working to become learning city candidates [33]. A recent example that deserves to be mentioned and congratulated is the city of Resita, which became the first in Romania to join UNESCO's "learning cities network", and whose aim is ensuring inclusive and equitable quality education, reducing inequalities, and developing decent work, but also making the city safe, secure, sustainable, and resilient while also establishing new partnerships [34].

We appreciate the city's commitment to development; nevertheless, we have noted a general absence of initiatives relating to the concept of learning cities in Romania, and especially in Bucharest. Given the importance and efficiency of this tool (considering the learning cities concept a tool, as we clarified in the introduction), we took the initiative to organize an experiment in public space by centering our vision on the citizen.

In order to give you a better understanding of this experiment, we would like to propose some activities similar to those we managed to conduct on public transport in Bucharest. These examples not only include studies, but also some companies' commercial activities, mentioned here because the similarity of the activities and the citizens' responses to them are relevant. In August 2012, Vodafone Romania, in cooperation with Humanitas Publishing House, launched Romania's first digital library in the city of Bucharest, and

this was kept open to citizens until October 2012. The Vodafone Digital Library offered a total of 49 titles and 10 audiobooks, but only one was available as a full-length e-book for free download to each phone or tablet (Mateiu I. Caragiale's *Sub pecetea tainei*), and if users requested another book in full e-book format from the "Vodafone Digital Library", they would be redirected to Humanitas Verlag's website, where they could purchase the book online [35]. However, this was a commercial activity and was not directly aimed at creating a sustainable society as only one of the books was free and the other QR codes led to books that could be read only after purchase. Another example is from Beijing. Under the initiative of the Beijing Subway and the National Library, Beijing's first underground library, "M Subway Library", opened in 2015 and provided citizens with high-quality book resources through public transportation platforms. In 2017, the M-Library project won the UITP Ambitious & Innovative Mobility Projects award at the Asia Pacific Montreal Global Public Transport Summit [36].

4.1. Research Questions and Challenges

We wanted to prove that there is interest amongst the citizens of Bucharest in a non-conventional, smart, and sustainable way of learning by offering them the opportunity to read books in the public space. The biggest challenges concerned the availability of resources (we were short on both time and money), communication with public institutions (so that they would allow us to use their space for our research), and, lastly, the promotion of the experiment. Our research questions were as follows: "is there any interest in this way of learning amongst the citizens of Bucharest?" and "how can you learn in a smart way in a smart city?" The responses we received to both questions led us to believe that this is indeed a viable way of learning.

4.2. Selected Idea, Aim, Objectives, Target Group, and Solution to Challenges

We started this experiment by narrowing down ideas concerning how we can quantify the interest that the citizens of Bucharest have in learning in an unusual location (i.e., a location other than an education establishment in which people typically gain knowledge and are provided with information). After brainstorming ideas and dismantling them, analyzing their pros and cons, we settled on two main ideas, both of which involved QR codes that would send the user to free sources of literature and that would allow us to monitor the traffic. The biggest difference between the two ideas was the proposed location: we debated whether to conduct the experiment on public transport or in parks. Eventually, taking into account the fact that the research would take place in November and early December, and keeping in mind the cold weather, we decided to conduct the research on the public transportation system.

Our main objective was to quantify the interest that the citizens of Bucharest have in learning smart in a smart(er) city. We also wanted to help make people's commutes more enjoyable by providing books for them to read. Moreover, we decided to plan and implement this idea as sustainably as possible by providing paperless books to everyone interested, and by encouraging citizens to use a green alternative to travel in Bucharest. In a similar manner, the local administration might choose to promote local talent (photographers, musicians, writers, actors, etc.).

That being said, we realized that our target group would mostly consist of young people and people with a higher level of digital literacy [37] because they are more familiar with usage of QR codes and are often more inclined to read e-books [38]. We decided to limit the target audience to this group because to be inclusive and encourage everyone we would need a longer period of time for the study and a much bigger publicity campaign, targeting almost all available communication channels, and our resources were too limited for this.

4.3. Research Methods

“Experimental research is a study that strictly adheres to a scientific research design. It includes a hypothesis, a variable that can be manipulated by the researcher, and variables that can be measured, calculated and compared. Most importantly, experimental research is completed in a controlled environment. The researcher collects data and results will either support or reject the hypothesis. This method of research is referred to a hypothesis testing or a deductive research method” [39].

“The term observational research is used to refer to several different types of non-experimental studies in which behavior is systematically observed and recorded. The goal of observational research is to describe a variable or set of variables. More generally, the goal is to obtain a snapshot of specific characteristics of an individual, group, or setting. As described previously, observational research is non-experimental because nothing is manipulated or controlled, and as such we cannot arrive at causal conclusions using this approach. The data that are collected in observational research studies are often qualitative in nature but they may also be quantitative or both (mixed-methods). There are several different types of observational research designs that will be described below” [40].

“The data analysis part of an integrative or critical review is not particularly developed according to a specific standard. However, while there is no strict standard, the general aim of a data analysis in an integrative review is to critically analyze and examine the literature and the main ideas and relationships of an issue. It should be noted that this requires researchers to have advanced skills, such as superior conceptual thinking at the same time as being transparent and document the process of analysis” [41].

We have decided to use the following three research methods:

- Experiment: we implemented the experiment for a short amount of time (~3 weeks) by displaying the QR codes on the LCD screens of buses and by printing the QR codes onto stickers and sticking them on the ticket vending machines (TVMs) at 19 of the most relevant metro stations (according to our target group).
- Observation: we observed the number of times the QR codes were scanned and correlated this with different key dates related to the experiment or to the social life of the city.
- Literature analysis: we analyzed specialized literature concerning the concept of learning cities as well as examples that dealt with public transport, libraries, and education, and this served as a foundation for our research and helped us better understand the complexity of the project.

4.4. Timeline, Implementation, Process, and Results

We started this project by brainstorming ideas for a period of five days between 25 and 31 October. In this early stage, we ran into some problems by debating intensely about the most suitable location for the experiment, but eventually we reached a consensus. We then started documenting the institutions that could help us during the process. This happened between 1 and 15 November. We reached out to them and, after several email and some phone exchanges, we eventually reached an agreement with the Bucharest Transport Society (STB), which agreed to display our QR codes for 20 s every 22 min. The QR codes for the LCD screens were presented with an explanatory slide, and for the next 5 days we tried to reach an agreement with Metrorex S.A. while also monitoring the traffic flow of the QR codes (which had reached a total of 10 scans split evenly between the 2 codes). We also created a video that showcased where to look for the QR code and how to access it inside the bus. After we reached an agreement with Metrorex S.A., we went on to glue stickers onto the ticket vending machines (TVMs) on 20 November (see Table 1), and one day after this the number of people accessing the QR codes more than doubled. The different QR codes were split evenly between ticket machines because, according to our agreement, we were only allowed to glue one sticker to each machine.

Table 1. No. of stickers/metro station.

Metro Station	No. of Stickers
Tineretului	3
Piața Unirii	9
Universitate	4
Piața Romană	4
Piața Victoriei	7
Aviatorilor	5
Aurel Vlaicu	4
Pipera	4
Orizont	2
Academia Militară	6
Eroilor	4
Grozăvești	4
Crângași	5
Basarab	4
Gara de Nord 1	5
Obor	5
Dristor 2	6
Izvor	2
Politehnica	3
Total	86

Source: direct personal investigation.

After this, we started promoting the initiative on social media. We used the following platforms: LinkedIn (one post), Facebook (four posts), Instagram (two posts), and Twitter (one post) (see Table 2). As of 3 December, we had made four Facebook posts. The first was posted on 21 November and had 75 reactions and 43 shares; the second post (also made on 21 November) was published by a page dedicated to the residents of Sector 5 (the page currently has 40,000 followers and 19,000 likes), reaching 18,903 people (as of 22 November) and provoking 55 reactions, 18 shares, and 19 comments; the third post was published by the same page dedicated to the residents of Sector 5 on 28 November, and it currently has 29 reactions, 3 shares, and 9 comments, having reached 4025 people; our last post on Facebook was published on 29 November and received 35 reactions, 6 comments, and 4 shares. On Instagram, the first post was published on 23 November and received 244 likes, 92 saves, and 4 comments, having reached 1220 people (it is worth mentioning that the post was shared by two influencers, one with 118,000 followers and one with 50,000 followers). The second Instagram post was published on 28 November and received 64 likes and 2 saves, having reached 481 people (see Table 3). On LinkedIn, our post was published on 23 November, reaching 463 people and receiving 9 reactions and 4 shares. On Twitter, we posted on 23 November, and the post currently has nine impressions, one like, and two engagements.

Table 2. Social media posts.

Social Media Platform (Profile Post)	Date	Reactions/Likes	Comments	Shares	Saves	Reach
Facebook (1st post)	21 November 2022	75	/	43	/	/
Facebook (2nd post)	21 November 2022	103	32	18	/	18,903
Facebook (3rd post)	28 November 2022	29	9	3	/	4025
Facebook (4th post)	29 November 2022	35	6	4	/	/
Instagram (1st post)	23 November 2022	244	4	/	92	1220
Instagram (2nd post)	28 November 2022	64	/	/	2	481
LinkedIn	23 November 2022	9	/	4	/	463

Source: Direct personal investigation.

Table 3. Features of social media profiles.

Social Media Platform and Profile	Followers	Likes
Facebook page dedicated to the residents of Sector 5	40,000	19,000
1st Instagram influencer	118,000	/
2nd Instagram influencer	50,800	/

Source: Direct personal investigation.

Before the first post on Facebook, our first QR code had been scanned 15 times (13 unique) our second QR code had been scanned 9 times (9 unique). This increased to 16 scans (13 unique) for the first QR code and 23 scans (12 unique) for the second QR code during the same day following the Facebook post. Our QR engagements grew from 29 scans (18 unique) for the first QR code and 33 scans (13 unique) for the second QR code to 39 scans (24 unique) for the first and 42 scans (16 unique) for the second 2 days after our first post on Instagram. At the time of writing (3 December), we have 66 scans (27 unique) for the first QR code and 61 scans (24 unique) for the second QR code. We did not find the reason why one of the books performed better than the other.

Both social media and the 24/7 display at Metrorex S.A. massively boosted our reach, and from this we have learned that campaigning/promoting on multiple channels is necessary for this type of learning method to be efficient. Another result we did not expect was the huge difference between the unique scans and the overall scans. We can explain this difference only by assuming there were people who scanned multiple times for various reasons, e.g., they wanted to show other people, they scanned once and closed the tab and thus had to scan again to resume their reading, or they were “hunting” all the QR codes in the hope that they might lead to different books (we have to keep in mind that not every individual who scanned a QR code had learned about our experiment through social media or word of mouth; they may just have scanned them out of curiosity, and we hope they had a pleasant surprise). Another factor we did not consider is the type of transportation. We believe that the number of scans increased massively after we glued the stickers to the metro ticket machines because the metro is used more frequently.

To conclude our experiment, we had to make use of various resources, such as human resources (for designing our idea, gluing the stickers onto the ticket vending machines (TVMs), and peeling them off afterwards), administrative resources (for reaching agreements with both of the public institutions we worked with in carrying out our experiment in the public area and for scheduling the right days and hours for gluing the stickers onto the ticket vending machines (TVMs)), financial resources (we spent RON 105.53 printing our stickers), and material resources (we produced 90 stickers that were 10 cm in size, meaning a total of 1 m² of printed stickers).

4.5. Improvements and Takeaways

Many improvements could have been made. For one, we could have spoken with the authorities earlier. Similarly, we could have spoken earlier and with more authors and publishers, preferably local ones, so that we could support local culture. We could have produced more QR codes with different forms of art, i.e., not just books, but also paintings, songs, poems, photographs, short videos, or any other form of art that can be efficiently transmitted to a phone browser. Another possible improvement would have been to promote the project on other communication channels, such as TV and radio, or inside public institutions, such as schools or universities, as well as on the social media pages of public authorities or well-known influencers. We could even have made it dynamic with multiple QR codes that show different pieces of art and that change weekly or biweekly. We could have provided better access to the QR codes by also showing them on the TVs inside the metro station, placing the stickers inside all the metro stations and all the buses, and by sticking them in some of the busiest places, such as markets, busy intersections, passages, parks, and museums.

The results of the project were positive. We received enough scans within the short window of time (~3 weeks) to be able to say that there are citizens who are interested in this form of smart education and that will choose a more environmentally friendly way of travelling and reading. We believe that this project should be improved by incorporating the points mentioned above and made a permanent form of education by the public administration.

Because this study was carried out with limited financial resources and within a short period of time, the readership was relatively small compared with the overall population. We believe that repeating this experiment with more financial resources would generate more accurate results. Ultimately, the purpose of this study was to determine whether there was a demand for this particular method of learning, and the results have proved that there is such a demand amongst the citizens of Bucharest.

5. Discussion

The findings of this study provide valuable insights into the potential of combining smart cities and learning cities. While the experimental results partly confirm the hypothesis that Bucharest public transport users are interested in unconventional, smart, and sustainable learning, there are still important implications for the development of smart cities and the potential to transform them into learning cities.

One of the main implications of this paper is the need for more a sustained and widespread promotion of smart and sustainable learning initiatives within smart cities. The experiment showed that promotion played a crucial role in informing potential readers about the books, so we can hypothesize that sustained promotion over a longer period of time could have led to greater participation and engagement.

Another implication of this study is the need for the better integration of smart technologies and data analytics in learning initiatives within smart cities. While the experiment used smart technologies such as QR codes on public transportation, there is a need for more sophisticated data analytics tools to track user engagement, preferences, and learning outcomes. This would facilitate the more effective adaptation of learning programs to users' needs and preferences as well as better assessment of the effectiveness of such initiatives in achieving their learning objectives.

Our research confirms what Osborne et al. [15] argued, i.e., that cities can achieve these outcomes by providing people with easily accessible and diverse educational choices, by demonstrating, among other things, that public transportation users in Bucharest show an interest in an unconventional, intelligent, and sustainable learning methods. This finding is supported by the data we collected and interpreted in Section 4. We would also like to mention the argument of Campbell [20], whose research suggests that by building a culture of innovation and experimentation, cities can become more resilient, inclusive, and sustainable in the face of rapid urbanization and globalization. This study promotes the idea that the integration of technologies and data analysis in the construction of learning cities could help learning city programs to adapt to the needs of users, and vice versa. It also represents an opportunity to increase the participation and involvement of local authorities, citizens, and civil society while requiring minimal effort (material, human, financial resources), as was demonstrated by the experiment in this study. Our research complements the previously mentioned literature, but also suggests that additional research is needed to better understand the challenges combining learning cities with smart technology to create resilient and sustainable societies.

Overall, the findings of this study contribute to a growing body of literature on smart cities and their potential as learning cities. Further research is needed to explore all the factors in more detail, and to develop more effective strategies for promoting smart and sustainable learning within smart cities.

6. Conclusions

We started this project wanting to test whether there was an interest amongst the users of public transportation in Bucharest in non-conventional, smart, and sustainable ways of learning. The experiment and its results proved our hypothesis partially; while there are clearly people that would be willing to try and embrace this way of learning, judging by the numbers we can conclude either that they form a very small percentage of the population or that the project needed to be conducted over a much longer period of time and/or that it needed better promotion. The results of the experiment showed that citizens were interested in the idea of a digital library on public transport, and their positive reactions on social media indicate the potential for the integration of smart city tools in creating more inclusive and accessible learning environments for urban communities. According to the data provided by the local authorities, in 2022 the total population of Bucharest and Ilfov amounted to 2,650,691 people. Additionally, the number of trips recorded by Metrorex S.A. and STB in 2020 was approximately 577 million. [42,43] By comparing these data with the results of this research and considering factors such as time, financial investment, advertising, and placement, we can conclude that the results of this research are representative of a large group of the total population, namely those that have a basic level of digital literacy. We proved that smart and sustainable learning is possible in Bucharest, we proved that some citizens are interested in this form of learning, and we proved that citizens, as well as the public sector, are embracing lifelong learning initiatives which in the end support the achievement of SDG 4.

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