From Ideas to Practice: Integrating Geospatial Education in Armenian Universities with the DEvision Project

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Abstract
This article delves into the implementation of geospatial education in Armenian universities through the APPEAR DEvision Project (https://www.devision.cloud). It explores how Yerevan State University (YSU) and the National University of Architecture and Construction of Armenia (NUACA) are integrating geospatial technologies into their curricula and study programs. Drawing from conceptual frameworks and practical insights, it examines the theoretical foundations, pedagogical approaches, practical implications, sustainability, future directions, and case studies supporting the DEvision initiative, offering a comprehensive overview of its transformative potential in Armenian higher education.

Keywords: APPEAR DEvision Project, Digital Earth, Geospatial Education, Interdisciplinary Collaboration, Online Learning

1. Introduction

Armenian universities are confronted with the task of modernizing teacher education and other academic programs to align with the evolving needs of the 21st-century classroom. The DEvision Project, a collaborative initiative aimed at integrating geospatial education into a broad range of curricula, emerges as a promising approach. This article document so how YSU and NUACA are embracing geospatial education through the DEvision Project, shedding light on its conceptual underpinnings, pedagogical approaches, practical implications, sustainability strategies, future directions, and case studies.

1.1 Theoretical Framework

At the heart of the DEvision Project lies a robust conceptual framework that informs its implementation and evaluation. Drawing upon seminal works in geospatial education [1] and [2], the project underscores the significance of spatial thinking, geographic literacy, and critical inquiry. Anchored in theories of experiential learning, the DEvision Project seeks to foster a profound understanding of the interplay between geography, technology, and education.

1.2 Pedagogical Approaches

The DEvision Project employs a diverse array of pedagogical approaches to engage students from a variety of disciplines in geospatial education. From interactive online courses to immersive field experiences and collaborative projects, students are exposed to a spectrum of learning opportunities. By scaffolding their learning experiences and facilitating hands-on exploration and reflection, the project nurtures critical thinking, problem-solving, and digital literacy skills essential for effective teaching in the digital era.

1.3 Practical Applications

Through the DEvision Project, Armenian universities are seamlessly integrating geospatial education into existing academic programs in practical and meaningful ways. Leveraging platforms like ArcGIS Online and Story Maps, participants gain firsthand experience in data analysis, spatial reasoning, and interdisciplinary collaboration. Through interactive mapping exercises and project-based learning activities, student build familiarity with geomedia and other digital tools and benefit from innovative approaches to teaching and learning.

2. Project Activities

DEvision employs a multifaceted approach to achieve its objectives. The project activities encompass curriculum development, creation of short courses (online/hybrid), capacity-building workshops, stakeholder engagement, and scholarship competitions. These activities are meticulously designed to elevate the quality of geospatial education and foster interdisciplinary collaboration.

2.1 Developed Courses

As part of DEvision, five courses have been developed and integrated into higher education curricula. These courses encompass the full spectrum of introductory geospatial competences:

1. Digital Earth Basics: Introduction to the principles and concepts of Digital Earth, covering geospatial data collection, spatial reference systems, and communication of spatial information.
2. Geospatial Models and Representations: Exploration of geospatial data acquisition and integration, raster and vector data data, open data principles, and spatial data infrastructures.
3. Geovisualization and Geocommunication: Techniques for creating and sharing web maps, classification and symbolization of spatial data, design for interaction, and 3D visualization.
4. Remote Sensing and Image Analysis: Fundamentals of remote sensing, platforms and sensors, imagery analysis techniques, and monitoring of spatial changes.
5. Spatial Analysis: Methods for creating information from spatial data, exploratory data analysis, distance-based analysis, multi thematic analytics, and identification of spatial patterns.

2.2 Case Studies

Advancing Geospatial Education at the National University of Architecture and Construction of Armenia (NUACA): NUACA is also spearheading geospatial education, leveraging the DEvision Project to enhance curricula and student learning outcomes. Through innovative coursework, professional development opportunities, and collaborative projects, NUACA is equipping teacher candidates with the knowledge, skills, and competencies needed to effectively integrate geospatial technologies into their teaching practice [3] and [4]. During the implementation of the DEvision initiative, teachers from partner universities were trained on the implementation of the Case Study teaching method in the field of Geo-information technologies. A teaching strategy is considered effective if it results in purposeful learning [5] and [6] and allows the teacher to create situations that promote appropriate learning [7] to achieve the desired outcome [8]. Since teaching methods impact student learning significantly, educators need to continuously assess the effectiveness of their teaching strategies to ensure desired learning outcomes for their students given today's dynamic learning environments [9]. As a pedagogical strategy, case studies allow the learner to integrate theory with real-life situations as they devise solutions to the carefully designed scenarios [9] and [10]. Another important known observation is that case-study-based teaching exposes students to different cases, decision contexts and the environment to experience teamwork and interpersonal relations as “they learn by doing,” thus benefiting from possibilities that traditional lectures hardly create [9] and [11].

This choice of teaching method is supported by the fact that nowadays, active teaching-learning is preferred especially in undergraduate programs because they not only make students more powerful actors in professional life [12] and [13], but they actually help learners to develop critical thinking skills [14]. In fact, students who undergo such teaching approaches usually become more resourceful in integrating theory with practice, especially as they solve their case scenarios [9] [15] and [16].

2.3 Case Study Teaching Method Implementation

Within the DEvision Project framework, NUACA has adopted the Case Study teaching method, a dynamic pedagogical strategy lauded for its active, problem-based, and student-centered approach. This method has been instrumental in cultivating critical thinking skills among students navigating the complexities of Geo-information technologies [17] and [18].

2.4 Development of Case Studies

In line with the collaborative spirit of the DEvision Project, teachers from partner universities contribute to the development of case studies. These real-world scenarios offer students practical applications of geospatial technologies, fostering hands-on experience and community impact [9][15] and [16]. Two examples developed by the NUACA’s teachers Mr. Stepan Khachatryan and Ms. Narine Harutyunyan are presented below:

Case Study 1: Enhancing Access to Fresh Produce in Yerevan (Developed for Spatial Analysis course): In Yerevan, small fruit and vegetable shops play a crucial role in providing fresh produce to locals, yet their visibility often suffers due to limited promotion.

To address this issue, a case study was undertaken to leverage geo-information technologies, particularly ArcGIS Online (AGO), to enhance the visibility and accessibility of these establishments. Led by GIS class students, the study aimed to collect, map, and analyze the distribution, accessibility, and price policies of small shops across the city (Figure 1 and Figure 2). ArcGIS Survey123 facilitated data collection, allowing students to gather information on shop names, produce prices, and capture photographs. The resulting maps depicted the spatial distribution of shops, highlighting areas of concentration and pedestrian travel time zones (Figure 3). By visualizing walking distances and accessibility metrics, the study identified underserved areas and proposed targeted interventions to improve access to fresh produce, illustrating the potential of geospatial technologies to address spatial challenges and promote community well-being. The details of the case study are presented in the following link: https://arcg.is/1CTfe41.

Case Study 2: Mapping Armenian Architectural Monuments Worldwide: Geographic Information Systems (GIS)-based technologies play a pivotal role in cultural heritage conservation, serving as robust platforms for research and display. Cultural heritage preserves spontaneous history and collective memories, shaping societal understanding and appreciation of historical narratives. Its preservation allows successive generations to comprehend and value historical significance, which holds profound implications for national cultural dissemination. GIS applications have transformed traditional operating mechanisms by equipping stakeholders with an information management platform for storage, analysis, management, and dissemination of data, alongside facilitating spatial analysis, risk prediction, evaluation monitoring, and data information integration calculation. enabling the creation of unconventional field mapping activities.

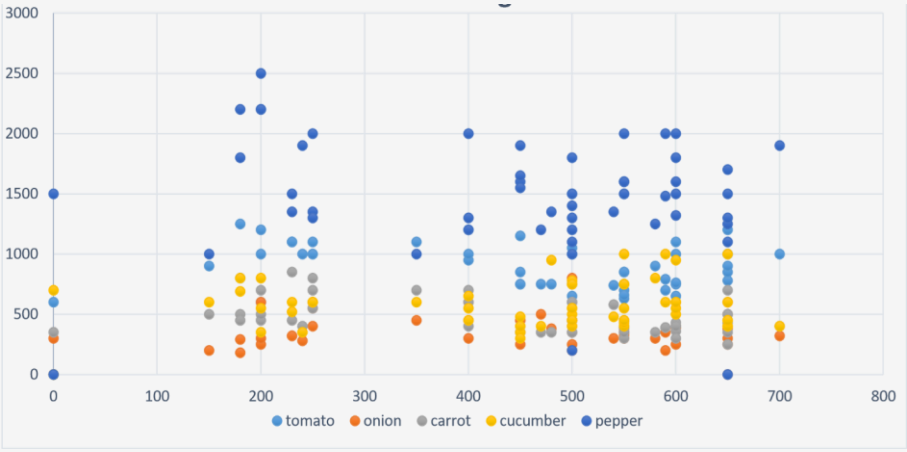

Figure 1: The prices of vegetables. Price, AMD (Y axis), distance from city center, m (X axis)

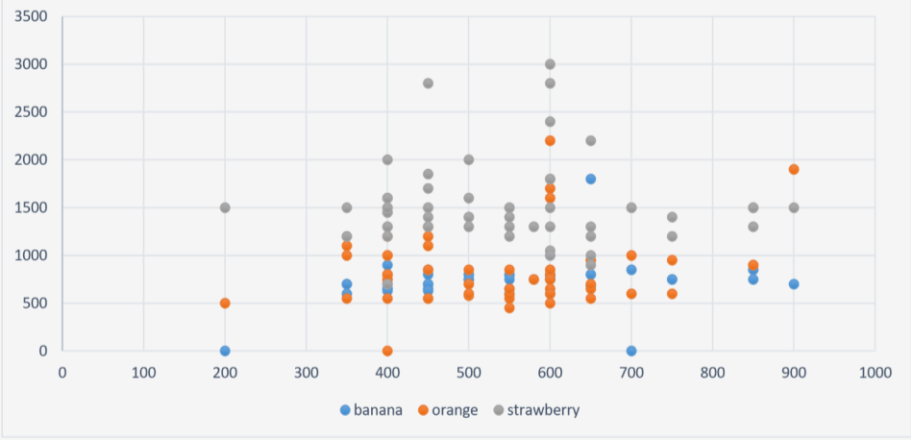

Figure 2: The prices of fruits, Price, AMD (Y axis), distance from city center, m (X axis)

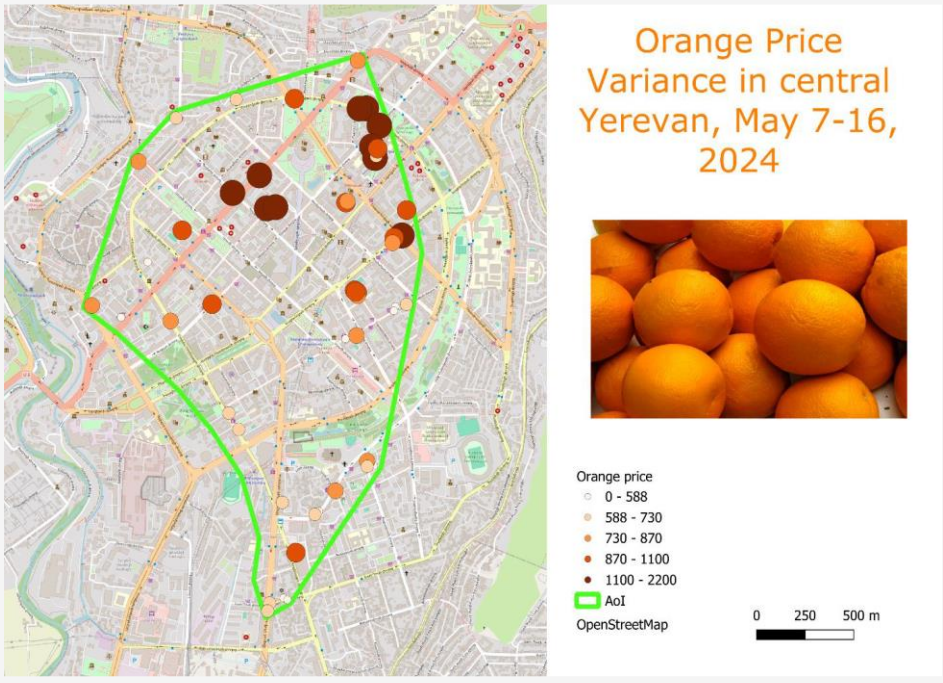

Figure 3: Spatial distribution of stores on the map

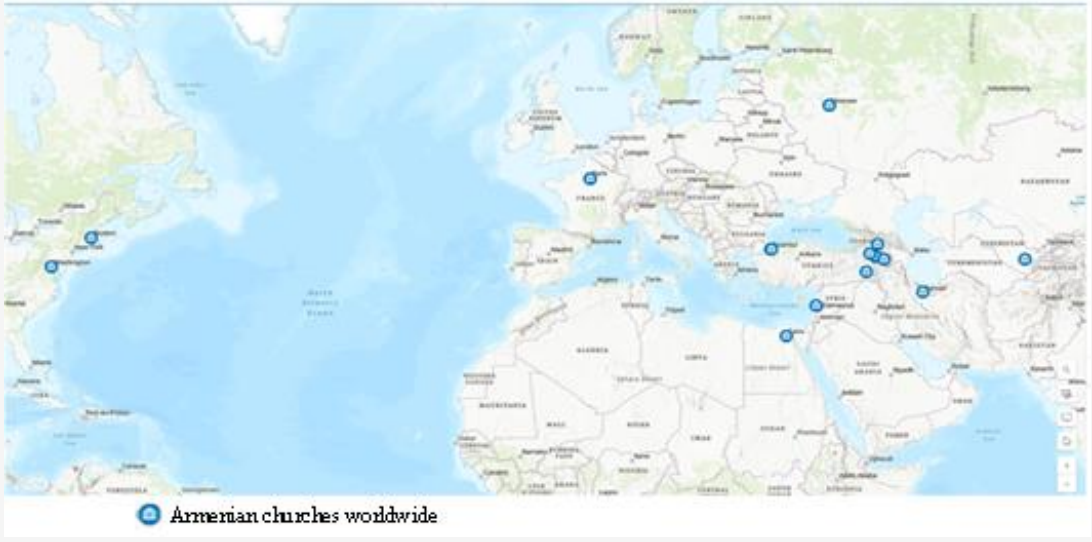

Figure 4: Map with the Armenian historical/architectural monuments

ArcGIS Online provides users with access to open-source solutions, available on desktop and mobile devices, this includes photo interpretation, location surveying, and documenting the materials used in constructing monuments of primary historical and cultural significance. Our research aims to illuminate the architectural achievements of Armenian architects worldwide over centuries. These man-made monuments have left a deep mark on the cultural values of humanity. By mapping all architectural masterpieces in one place, it offers an opportunity to view, collect, update, and monitor monuments online within the same platform. While many works have been collected, there remain numerous monuments yet to be documented. Thus, our case study invites further exploration by researchers in these fields. GIS enables mapping, editing, adding historical overviews, managing, analyzing, and preserving databases (Figure 4). Additionally, tools like the "Survey123" application facilitate mapping and data collection for lesser-known monuments and churches, often familiar only to local communities.

In line with this, another case study tasked our students with mapping monuments and churches in their regions, gathering historical insights from native sources. This application proves invaluable in identifying, mapping, and preserving historical and cultural monuments in the most inaccessible locales. The details of the case study are presented in the following link: https://devision.maps.arcgis.com/home/item.html?id=8485ad44f0c64dc4a60f8a1c69b331a2.

3. Results

The implementation of DEvision has led to the successful development and integration of geospatial education modules into higher education curricula. Through online learning resources and collaborative initiatives, DEvision has empowered students and educators with the skills and knowledge necessary to navigate the digital landscape. Moreover, the influence of DEvision aims beyond traditional spatial disciplines, impacting various disciplines such as urban planning, environmental science, and civil engineering. By integrating geospatial education into their curricula, partner institutions have enriched the learning experience for students and prepared them for the challenges of the digital age.

3.1 Effectiveness of Teaching Methods

Drawing from educational theory, this is very clear that effective teaching methods are those that foster purposeful learning and create conducive learning environments. By continuously refining their teaching strategies, educators ensure that students are equipped to thrive in today's dynamic educational landscape [5][6][7] and [8]. The DEvision initiative employs specific educational methods and principles to implement blended learning across various disciplines [19]. This approach combines online education with traditional classroom activities through digital platforms, allowing teachers and students to interact both in person and online. Blended learning fosters individual progress while maintaining a collaborative learning community, emphasizing personalized educational experiences tailored to support each student’s unique learning path [19].

3.2 Integration of Real-life Scenarios

NUACA's emphasis on integrating real-life scenarios into the curriculum enriches student learning experiences. Case studies serve as bridges between theory and practice, empowering students to apply theoretical concepts to tangible challenges, thus fostering deeper understanding and engagement [9] and [10].

3.3 Sustainability and Long-Term Impact

While the integration of geospatial education presents exciting opportunities, ensuring sustainability and long-term impact are crucial. Addressing issues such as access to technology, digital literacy, and ongoing professional development for educators are essential steps in sustaining the momentum of the project. Moreover, fostering partnerships with government agencies, non-profit organizations, and industry stakeholders can provide resources and support needed to sustain geospatial education initiatives beyond the scope of the project.

3.4 Future Directions

Potential future directions for the DEvision Project and geospatial education in Armenian universities include expanding the reach of geospatial education initiatives to more institutions, developing advanced courses and specializations, and exploring innovative pedagogical approaches and emerging technologies. Additionally, continuous evaluation and adaptation of geospatial education initiatives are essential to keep pace with evolving technological and educational trends.

3.5 International Collaboration and Knowledge Exchange

International collaboration and knowledge exchange are vital in advancing geospatial education. By sharing experiences, best practices, and resources with global partners, Armenian universities can enrich their geospatial education initiatives and contribute to the broader international discourse on geospatial literacy and digital transformation in education. Moreover, international collaboration can facilitate opportunities for student and faculty exchange programs, joint research projects, and cross-cultural learning experiences, enhancing the overall quality and impact of geospatial education initiatives.

3.6 Policy Implications

Recognizing the value of geospatial literacy and digital skills in the 21st-century workforce, policymakers should prioritize investments in infrastructure, resources, and training programs to support the integration of geospatial education at the national level. Developing policies and regulations that promote interdisciplinary collaboration, open access to geospatial data, and innovation in education can foster a conducive environment for the growth of geospatial education initiatives.

4. Conclusion

The DEvision Project offers Armenian universities a unique opportunity to enhance study programs through the integration of geospatial education initiatives. By drawing on theoretical frameworks, pedagogical approaches, practical applications, sustainability strategies, future directions, and case studies, Armenian universities can prepare educators to navigate the complexities of 21st-century education and empower students to become critical thinkers, problem solvers, and global citizens. As Armenian universities continue to embrace geospatial education, they will play a pivotal role in shaping the future of teaching and learning in Armenia and beyond.

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