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THE PROJECT METHOD IN EDUCATION OF GEOINFORMATION SPECIALISTS

METODA PROJEKTU W NAUCZANIU SPECJALISTÓW W GEOINFORMACJI

Introduction

One of the main tasks of any university is to provide students with comprehensive and interdisciplinary education at a general academic level. At the same time, the university should create conditions for students to be able to use their knowledge in wider practical context.

Interdisciplinarity and implementing practical applications are of particular importance in the process of training specialists in the field of geoinformation. Studies in this major are designed to allow for acquisition of expertise in such fields as the theoretical basis of Geographic Information Systems, and develop skills to create and manage such systems, perform spatial analyses and administer spatial data. Moreover, the students' personal skills are developed, allowing them to independently and reliably perform their cognitive and practical tasks, work in a team, communicate effectively or become aware of the need to constantly improve their knowledge. This task requires implementation of a number of subjects as well as the use of appropriate educational strategies (Cichoń, Piotrowska 2012; Jażdżewska, Cybula 2012).

One of them is the project method, in which students have to exhibit high degree of independence in performing their tasks. On the other hand, the academic teacher is tasked primarily with creating appropriate working conditions, motivating the students and participating in the cognitive process.

The aim of the study is to present the possibilities of using the project method in educating geoinformation specialists, as illustrated by the pro-

ject "Geographic Information Systems in Tourism" in the course of geoinformation training within the framework of the Bachelor's degree studies at the University of Łódź.

Project Method

The project method was developed in the 19th century in the United States by pedagogist John Dewey and has been used at various levels of education until today. Out of the numerous available definitions of the method (J. Dewey, W.H. Kilpartick, C.R. Richards, W.W. Charters, J.A. Stevenson, J. Fowler and R.Walker, M.S. Szymański), we may choose one main feature, namely independent learning by performing practical activities in order to achieve a previously set goal (working on a topic). Depending on the variant used, the goal may be specified by the teacher or a project team, which is described as preferred in literature as it gives more independence to the project team but also makes the execution much more dependent on the creative potential of its members. But the most important feature is linking the specified goal with the surrounding. We should point out the interdisciplinary nature of any endeavours, that allows for capturing the relationships between various scientific disciplines as well as for their practical applicability (Suchodolski 1963; Szymański 1999; Szymański 2000; Zajac 2015).

The implementation of the project method may be divided into three phases. The preparation phase primarily involves the determination of the subject matter to be worked on, an introduction to the subject but also: selecting groups, gathering preliminary information, scheduling the project execution and developing evaluation criteria. If the students encounter this method for the first time, they should be additionally primed for this way of working. The project execution phase mainly involves independent work and students taking actions toward reaching the goal but also regular consultations to support students activities. In this phase, results are prepared and presented to the group. The last phase, i.e. evaluation, includes evaluation of the project by the teacher but also self-evaluation by the students as well as social evaluation, i.e. evaluation of each student by the rest of the group. This assessment should serve as feedback for the project participants regarding their strengths and weaknesses, and allow them to use it in the future (Szymański 2000; Zajac 2015).

This method, despite being based on students' independent work, does not diminish the role of academic teachers as it only changes their role from an expert in a given field into a person providing the students with

the best possible work conditions. It is important that the teachers do not impose their points of view nor suggest solutions but just discreetly control and support the actions of their group (Szymański 2000; Zajac 2015).

We must reiterate that the process of evaluation is different from standard classes. In this case, it is not conducted by the teacher either but it is left to the participants of the project and is a part of it. Evaluation may be based on criteria specified at the beginning. It covers not only the effects but mainly the activities that have led to them. It may also be carried out during the project, e.g. to correct certain actions undertaken by the project group members (Szymański 2000; Zajac 2015).

Practical Exemplification of the Project Method

One example of this method used in the process of education of geoinformation specialists may be the training session conducted within the framework of the "Geographic Information Systems in Tourism" as a part of the Bachelor's degree studies of geoinformation at the Faculty of Geographic Sciences in co-operation with the Faculty of Mathematics and Computer Science of the University of Łódź. The subject was first introduced in 2014/2015 offering 52 teaching hours (6 ECTS points) to 18 students participating.

The vague name of the subject gives the teacher a wide range of the detailed project topics to choose from. In this case, the topic was chosen by prof. Iwona Jażdżewska, associate professor at the University of Łódź, who proposed the development of a¹ tourist geoportal related to murals present in the urban space of Łódź.

Murals

Murals constitute a form of visual art (street art) derived from graffiti. The name comes from the Spanish word for decorative wall painting. Murals are characteristic since they are present in public space and their artistic and aesthetic values are high. Their aim is to transmit the view of the creator and shape the surrounding, which distinguishes them from graffiti which is only meant to mark the author's presence. In Łódź, the first murals were created back during the Communist times as large-format

1 Geoportal means the Internet website or an equivalent providing access through electronic means to such spatial data services as: searching, browsing, downloading and processing. Spatial data relates directly or indirectly to a specific location or geographic area (EU Directive 2007).

“advertisements” of companies operating at that time. They mostly covered gable walls uncovered after adjacent buildings got demolished. As such, they served a practical purpose of masking unsightly facades. We should, however, remember that have significant artistic value as those are the works of renowned artists that at that time referred to the then current artistic trends. Not all of them have survived, some have disappeared, some – painted over in the 1990s – have been preserved under a layer of paint until deteriorating facades have uncovered them again (Mokras-Grabowska 2014).

Interest in murals grew after 2008, when ms² art museum was created to promote modern art, including street art. In 2009 the Urban Forms Foundation was formed, the goal of which has been to promote urban art. Its operations include the creation of the Urban Forms Gallery consisting of large-format artistic painting on the wall of tenement houses and blocks of flats in Łódź. Currently it consists of more than 30 wall paintings. The collection constitutes a new tourist space for the city. According to the surveys, the collection is popular among local people who are thus prompted to learn about their city, and it serves the purpose of revitalisation and revival for urban spaces (Matulewski, Świeściak, Makohonienko 2015; Mokras-Grabowska 2014).

The accumulation of art forms in the city as well as mapping the routes for seeing them have resulted in an influx of individual tourists and organised groups. This means, that they have become another downtown attraction. At the same time, they have contributed to improvement of the tourist attractiveness of areas that have so far been overlooked by tourists (Mokras-Grabowska 2014).

Preparation phase

Preparation of the project from the educational point of view is the teachers' responsibility. In this case it has meant the commitment of the authors of this paper as well as computer science and geodesy specialists.

The main task has involved the inclusion of teaching outcomes² assigned to the module, the subject of which is in the curriculum. The outcomes will be achieved during the course based on the students' present knowledge of geoinformation, programming and the GIS web applications.

² <http://infogeolog.uni.lodz.pl/wp-content/uploads/2013/06/infogeolog-geoinformacja.pdf>

Tab. 1. Activities performed by the academic staff and students in the first phase of the project (source: own study, from B. Zajac (2015))

Teacher activities	Student activities
Selection of the project topic	
Determination of spatial scope of works	
Preparing students for working with the project method	Getting to know the project method
Introducing the students to the subject matter of the project	Getting to know the topic of the project
Providing possible sources of information	Evaluation of available sources of information and finding new ones
Motivating for action	Collecting and processing information on the basis of available sources
Determining the overall work schedule (field and lab work)	Analysis of the work schedule
The choice of the number of project groups and people in each team	Division into groups
Presentation of the standard of the final result of the project	Evaluating the feasibility of the project
	Creating a project outline
Approval of the detailed work schedule	Establishing a detailed work schedule, taking into account the general schedule
Establishing evaluation criteria	Establishing evaluation criteria

The aim of the project has been to create a geographic information system related to tourism and linked to the presence of murals in Łódź. It was decided that the project needed to include two parts: I. the part devoted to collection of spatial data in the field of tourism and II. the part, during which the GIS system would be designed to allow for presentation of this information. After determining the subject and scope of field work, preparation works and the initial phase of the project were started. In this phase, project leaders were doing most of the work (Table 1).

Since the class group had never participated in such projects, students had to be prepared for the work using the project method. First of all, they had to be made aware that they were responsible for organising and performing the task as well as for working in a team. Then they were introduced to the subject matter of the project. Issues that were discussed included tourism, tourist traffic, murals as forms of visual art and their relation to the city. Other topics included geoportals, their creation and operational principles as well as spatial information and Java development. Possible sources of information concerning the project were also provided. At this stage, the timeframe (deadlines) and division of work in the project into field and lab work were also introduced. The project started with the field work due to the weather condition that is usually better at the beginning of the winter semester (October – November) as well as the need to collect spatial information concerning the objects – murals that were to be presented in the geoportal created during the lab work. The lab work that mainly included data preparation, design and development, was planned for the second part of the semester (December – January).

The next step involved determining the number of project teams and the number of people in each of them. This parameter was set by the leaders as the students lacked experience in working with this method. It also allowed for even division of the city during the field work, so that no single group ended up overloaded with work.

Six three-person groups were established to have each of them survey one district of the city (Bałuty, Widzew, Górna, Polesie, Centrum). Two teams were assigned to survey the downtown area as the murals were more numerous there. Participants were allowed to choose their teammates, while the leaders just approved their division.

The next step involved the teachers determining the standard project results, namely a basic geoportal containing information about murals found in Łódź.

The project group had some time to familiarise themselves with the subject matter, gather information, and evaluate the feasibility of the project. This allowed students to create a project outline containing, among others, the main goals, activities, and expected time of completion. After that, a work schedule was set, taking into consideration the divisions instituted earlier and the dates for the field and lab work.

The last stage of this phase involved the determination of evaluation criteria. It was agreed that the leaders would evaluate: the quality of collected spatial data (completeness, quantity, precision, aesthetics), promptness of task completion (according to the schedule), proper Java implementation of data entry modules for the geoportal as well as data edition and display, and the end result of the project (presentation of the geoportal by the project team). The project also involved self-evaluation of each team as well as peer-review of each team by the other members of the project.

Execution Phase

In this part of the project, the division into the field and lab work is the most prominent. The role of the teachers changes. They are now providing the group with as much independence as possible, assuming the roles of observers and advisors (tab. 2).

The field work was preceded by a query concerning murals in Łódź conducted by the project teams. Printed sources, such as scientific papers, guidebooks, etc., as well as online sources were taken into account. Based on information gathered in regard to the murals located in assigned areas, each team used the GIS ArcMap 10.2 and data from the Web Map Service (WMS) to plot routes to collect spatial data. Field data was gathered using mobile multimedia devices and applications that measure GPS coordinates. Each project team completed the previously plotted route and documented the murals found along it. The collected information included:

- photographs of murals,
- coordinates (the coordinate system PUWG 1992) of their locations,
- address of the building where the mural is located,
- assessment of the mural condition (good/bad).

Each group entered their data into a table which was specified in the outline and facilitated later merging. In addition, each mural was further described using data from previously found sources, such as the date of creation, authors and a brief note (fig. 1).

The progress of the field work was discussed at weekly meetings (during classes). Each group presented the data they collected, which was then evaluated by the remaining participants.

Most comments were related to the photographic documentation of murals. Other participants often expressed reservations concerning the qual-

Tab. 2. Activities performed by the academic staff and students in the second phase of the project (source: own study, from B. Zając (2015))

Teacher activities	Student activities
Consultation meetings with students during classes	Participation in consultation meetings with teachers
Supporting students' activities	Implementation of tasks according to the agreed schedule
Observing students' activities	Gathering information on murals from various sources
Assistance in gathering means needed to collect spatial data, present the project	Planning of the field work
Monitoring the progress of the project	Acquisition of spatial data concerning data in the field: measuring the coordinates of a mural, photo-graphic documentation, assessment of murals' condi-tion
Verification of sources and information regarding murals	Expanding information on murals based on other sources
Observation and support for decisions concerning the selection and evaluation of data quality.	Selection and analysis of collected data in order to assess the related quality (photographic documenta-tion) or possible use in the project (additional de-scriptions of murals)
Preparing the project database	Developing a module for entering data into the pro-ject database
Interventions and assistance only in difficult and crisis situations	Developing a module for entering data into the pro-ject database
Interventions and assistance only in difficult and crisis situations	Entering system data into the project
Providing assistance from outside experts in the field of computer science (programming)	Developing a module allowing for the display of entered data as icons on a map
	Developing a module allowing for the display of de-tailed data concerning each object – the mural
	Developing a module allowing for changing the mu-ral-related data
	Developing a module allowing for the display of col-lective summary of the geoportal data
The organisation of summary classes	Presentation of the project



Fig. 1. Examples of photographs of murals taken by one of the project teams (from the left: the Holy Warrior, ul. 28 Pułku Strzelców Kaniowskich 48, the author: Inti; The Priest and the Devil, ul. Srebrzyńska 2, the author unknown, the Urban Forms Gallery al. Politechniki 16, authors: ETAM CREW)

ity of photographs, that were meant to show the painting in their entirety and in good lighting, according to the project description

The progress of the field work was discussed at weekly meetings (during classes). Each group presented the data they collected, which was then evaluated by the remaining participants.

Most comments were related to the photographic documentation of murals. Other participants often expressed reservations concerning the quality of photographs, that were meant to show the painting in their entirety and in good lighting, according to the project description. Not all images complied with the above requirements and some buildings required repeated photographing. One of the problems encountered by the team was the selection of collected data. There was a dispute concerning the inclusion of murals in very bad condition or completely invisible but present in the source data. This phase resulted in spatial data concerning 149 murals, 61 out of which were created after 2000, including the Urban Forms Gallery, and 21 created before 1999. Their condition was determined as very good and good. The condition of the remaining 67 ones is bad, they are painted over, covered or cannot be found. There is no data on the date of their creation, either.

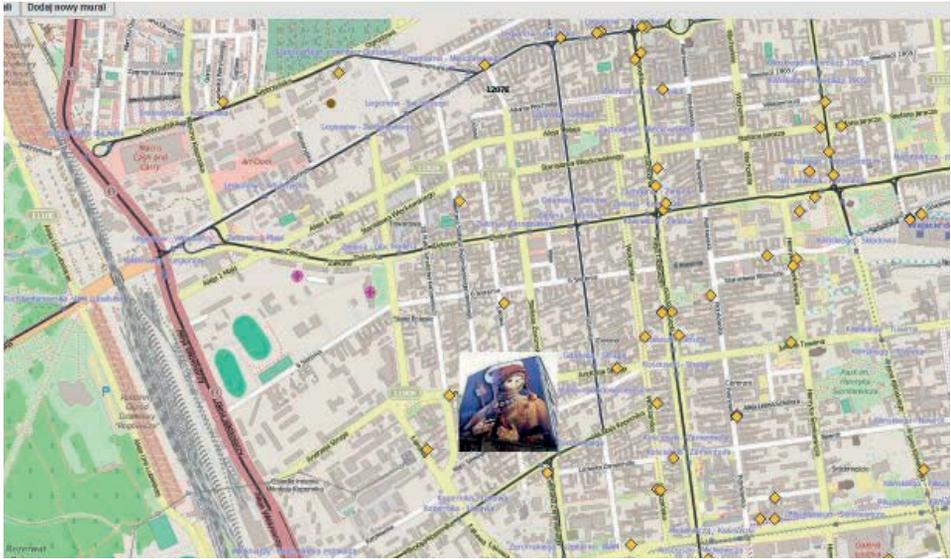


Fig. 2. The main window of the geoportals

Project Implementation Phase

In this phase, students implemented individual modules of the geoportals. The project included the following modules:



Fig. 3. Geoportals pop-up menu



ID	34
Nazwa	Święty Wojownik
Lokalizacja	Strzelców Kaniowskich 48
Autor	Inti
Wykonanie	Inti
Rok powstania	2012
Stan	bardzo dobry
Opis	Na obrazie przedstawiony został wojownik w charakterystycznym dla folkloru Ameryki Południowej stroju.

Zamknij Zmień dane

Fig. 4. Geoportal window displaying mural details

- a module for adding data to the geoportal database,
- a module for displaying murals as icons on the OpenStreetMap maps,
- a module for obtaining all data concerning individual murals, including photographs,
- a module for editing the data of individual murals,
- a module for displaying aggregated data on murals.

Java was chosen for the implementation of the geoportal as it allows for quick creation of complex computer systems as well as access to systems for the management of a relational and object databases from multiple providers using the JDBC programming interface. In addition, Java has a built-in exception handling, which allows for uniform handling of user data entry errors as well as when adding and acquiring data from a database. The selection of Java as the programming language used in the project implementation has also allowed for the use of the application programming interface (API) of the OpenStreetMap. It is a set of classes that display various geographic objects on a map as icons. The OpenStreetMap API has structures, in which coordinates are entered for objects, so they are displayed in their real locations.

Tab. 3: Geoportal window showing aggregated data on murals

ID	Nazwa	Adres	Autor	Wykonanie	Rok powstania	Stan	Opis
216	Baloon	Uniwersytecka 3	Mateusz Gapski	Etam Ciem	2012	bardzo dobry	kolorowo ubran...
217	Łódzkie Przed...	ul. Piotrkowska...	J. Oplustil, M. B...	brak danych	1956	budynek rozobr...	Reklama domu...
218	brak danych	ul. Północna 13	brak danych	brak danych	brak danych	zły	Widnieją na ni...
219	brak danych	Jaracza 59	Grzegorz Gonsi...	Grzegorz Gonsi...	2010	dobry	biała postać z k...
221	brak danych	ul. Północna 19	brak danych	brak danych	brak danych	zły	Reklama znisz...
228	Zakłady Włókie...	Piłsudskiego 75	Jerzy Jankowski	brak danych	brak danych	nieistniejący	brak danych
230	Fotograficzna S...	ul. Zachodnia 34	Jerzy Jankowski	Ryszard Macha...	brak danych	budynek rozobr...	Reklama sieci ...
231	Państwowa Ag...	ul. Struga 21	Zdzisław Bek	Antoni Adamkie...	brak danych	zabudowany	Reklama Państ...
233	Kwiaty	Rzgowska 77	brak danych	brak danych	brak danych	zamalowany	Na jego kompo...
235	Biblioteki Śród...	ul. Zachodnia 7...	Jerzy Jankowski	Ryszard Macha...	brak danych	budynek rozobr...	Mural przedsta...
236	„SPOLEM” - Do...	Tuwima 100	brak danych	brak danych	brak danych	nieistniejący	brak danych
238	Przedsiębiorst...	ul. Kościuszki 2	Zbigniew Wład...	Ryszard Macha...	brak danych	zamalowany	Reklama nawil...
244	Powszechna S...	ul. Jaracza 33/3...	brak danych	brak danych	lata 70	zamalowany	Reklama Pawil...
248	„POLDROB”	ul. Pomorska 30	Jerzy Jankowski	Ryszard Macha...	brak danych	skuty z tylniem	Reklama prze...
249	Robotnicza Sp...	ul. Zamenhofa ...	Ryszard Macha...	Ryszard Macha...	brak danych	zamalowany	Reklama Ruchu
252	Przedsiębiorst...	ul. Legionów 7	Zbigniew Łopat...	brak danych	brak danych	zamalowany	Reklama przed...
254	Restauracja Ka...	ul. POW 44	brak danych	brak danych	brak danych	zamalowany	Reklama resta...
258	brak danych	ul. Więckowski...	MORIK	MORIK	2014	bardzo dobry	brak danych
261	brak danych	al. Kościuszki 32	Kenora (Hiszpa...	Kenora (Hiszpa...	2011	bardzo dobry	Abstrakcyjno-g...
281	brak danych	ul. Zachodnia 61	Sepe i Chazme...	Sepe i Chazme...	2011	bardzo dobry	Geometryczne, ...
285	Przedsiębiorst...	Zachodnia 84	Jerzy Jankowski	Ryszard Macha...	brak danych	nieistniejący	Reklama Otexu...
286	Galeria Urban ...	Politechniki 16	Aryz	Aryz	2012	bardzo dobry	Gnijące kwiaty ...
288	Więzień z oboz...	ul. Wojska Pols...	Piotr Saul	Piotr Saul	2012	dobry	Mural z edycji ...
289	Zakład przemy...	al. Politechniki ...	Jerzy Jankowski	R. Macharowsk...	lata 70	zły	Na murze przy...
291	brak danych	ul. Zachodnia 52	Gregora (Gzeo...	Gregora (Gzeo...	2009	bardzo dobry	Maszyna do szy...

The main window of the geoportal (fig. 2) shows two buttons “Show mural data” and “Add new mural” that allow, respectively, for viewing aggregated data on murals and adding a new mural. Moreover, the window shows icons for individual murals entered into the system as well as a thumbnail of a mural which is shown in the geoportal window after the mouse is hovered over the icon.

Right-clicking on the thumbnail displays a context menu with the following choices: “Delete” and “Show data” (fig. 3).

Choosing “Delete” removes the mural from the database, while choosing “Show data” displays detailed data for the selected mural (fig. 4).

Clicking “Change data” allows the user to edit data for the selected mural. Clicking “Show mural data” in the main window shows aggregated data on murals (tab. 3).

The implementation phase of the project ended with the presentation of the finished geoportal.

Evaluation Phase

The evaluation phase was conducted as a group discussion following the presentation of the geoportal at the last planned consultation meeting. In accordance with the criteria adopted in the first phase of the project,

Tab. 4. Activities performed by the academic staff and students in the third phase of the project (source: own study, from B. Zajac (2015))

Teacher activities	Student activities
data quality evaluation	self-evaluation according to criteria
evaluation of timeliness of task completion, according to the schedule	peer-review at team level
evaluation of correct implementation of individual modules	
evaluation of the accuracy of data entered into the system	
evaluation of the final result	

evaluation applied to the timeliness of the project execution according to schedule, the quality of spatial data, correct implementation of individual geoportal modules, as well as the final product, namely the geoportal and related functioning (tab. 4).

Each participant performed a self-evaluation (on a scale of 2-5), taking into account such criteria as: involvement in the project, timeliness of completing tasks they were entrusted with, creativity, team work skills, the end result. Additionally, the team-level peer review was performed. Each team used a scorecard to evaluate the other groups on a scale of 2 to 5, taking into account such criteria as: involvement in the project, timeliness of completing task they were entrusted with, work effort, creativity, co-operation. It should be emphasised that the peer review of individual teams was also performed at the consultation meeting during the project, e.g. when individual teams presented their data.

Summary

The application of the project method to implement the Geographic Information Systems in tourism had very good effects. First and foremost, the main goal, namely the geoportal for murals in Łódź, was achieved. The project allowed students to expand their knowledge, acquire and improve the skills useful in the labour market, such as communication, team work, using information, problem solving or decision making.

One great advantage of such classes is their interdisciplinarity which is key in the process of educating geoinformation specialists. Moreover, its practicable nature pushes the students to use their knowledge and skills in computer science, surveying and social sciences. One pre-condition for the success of such classes is the involvement of academic teachers as this kind of work demands greater flexibility and quick reactions to students' needs, which often involves the need to expand their own knowledge and skills.

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