

Chapter 13

Social Aspects of Teaching: Subjective Preconditions and Objective Evaluation of Interpretation of Image Data

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Abstract Between both learning and teaching processes, there is an ongoing relationship showing specific teaching and bidirectional relationships between teachers and their students. The teachers can influence their communication and interactions with students in a very favourable or, on the contrary, unfavourable way. Speaking about the area of attitudes and values shaping the relationship between teachers and their pupils, the article focuses on the part of subjective assumptions concerning pupils' progress when working with specific materials— aerial and satellite image and map interpretation. The survey respondents were primary school teachers and primary school students aged 11 and 15. Teachers and pupils' subjective assumptions were mutually compared; subjective assumptions were compared with objective data—the test results concerning pupils' work with image data. The survey has proved that (1) there is a strong correlation between the teachers' assumptions concerning the difficulty to interpret an image by themselves and the assumption concerning the difficulties encountered by their pupils; (2) the pupils' assumption concerning the difficulty when working with some material (satellite images in false colours) significantly differs from the objective success rate: students expect very difficult tasks whereas they are actually very successful; (3) the teachers and students differ about their opinion concerning the use of satellite and aerial images during the teaching process; the teachers declare a higher level of significance than students; (4) the teachers expect the satellite and aerial image data to be far more attractive than the pupils expect.

Keywords Teacher's attitude • Subjective assumptions concerning success • Aerial and satellite photograph interpretation

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13.1 Introduction

Learning is a lifelong process, during which people change their knowledge of the natural and human environment, their behaviour, activities and their personal features and their self-image (Mareš 1998). The above mentioned changes are primarily based on experience, i.e. the results of previous activities, which are transformed into systems of knowledge. The experience is either individual or it is based on the individual's identification with social experience. The teaching process is a system of planned activities aimed at reaching a set of educational objectives. The system includes sub-components—subsystems: a control system (teacher), a controlled system (pupil), curriculum, teaching resources and material conditions. The sub-components are linked with bonds; within them a transmission of various types of information is implemented. Between both learning and teaching processes, there is an ongoing relationship showing specific teaching and bidirectional relationships between teachers and their students (Dunn and Dunn 1979). The teacher can act in a very favourable or unfavourable way, choosing deliberately educational activities. The teacher's communication and interaction with students seems to be very significant (Čáp and Mareš 2001). The interaction between a teacher and a student is connected not only with their relationships and the curriculum, but also with the teacher's interpretation of a pupil's behaviour and the pupils' interpretations of teacher's behaviour. Another important aspect that is reflected in the interaction and communication between a teacher and a pupil is the subjective perception of the other person. The teacher's attitude often affects the way the students perceive their position from the teacher's point of view. Subjective factors in the teaching profession are important due to the number and variety of tasks and the large number of factors that affect the teaching process (Janík et al. 2014).

The teachers' quality is generally considered a key factor that significantly affects the quality of school education (Crone and Teddlie 1995; Kratochvílová 2007; Hoskova-Mayerova 2017). When speaking about the attitudes, values and personal features of high quality teachers, most authors focus on the following characteristics: a devotion to the profession, enthusiasm, a high level of commitment and the amount of energy dedicated to their work, a strong commitment to work with pupils, empathy, a positive attitude to pupils, conviction, faith (belief) that all pupils can be successful under certain conditions and that the teachers are able to help them fulfil their potential and succeed (e.g. Minor 2002, Kramáreková et al. 2016a). The presented study focuses teachers' attitudes, especially their expectations concerning the pupils' success rate. It deals with a teaching process involving the use of aerial and satellite images and maps. It uses information from similar researches that were conducted in the Czech Republic and in the Slovak Republic, too (e.g. Kramáreková et al. 2016b). These resources have become a subject of research and other projects. For example (Král and Řezníčková 2013) examined the current situation and the main barriers to the expansion of geographic information systems, including aerial and satellite photographs in teaching in

secondary schools in the country. The second example is research to verify the disparity of opinion geography teacher elementary, middle and high schools on the importance of learning various skills, including use of aerial and satellite images (Řezníčková et al. 2011, 2014; Baysen et al. 2016).

The study evaluates identical or different assumptions of both the teachers and the pupils during a learning process, and the teaching process involving the support of material concerning the remote exploration of the Earth. It compares teachers' and pupils' subjective assumption concerning the difficulty of working with aerial and satellite images, the relation between the teachers' anticipated difficulty for teachers and their opinion about the difficulty for their pupils; it notices the similarity or differences of opinion about the attractiveness of aerial and satellite images and its use in the teaching process.

13.2 Objectives and Research Methodology

Both, the teachers' and the pupils', subjective assumptions are involved in the teaching process. The presented study continues the extensive research concerning the image data interpreting by pupils and adolescents (11–19 years) see Svatonova and Rybansky (2014). The research involved research concerning a group of pupils and students and their aerial and satellite image data interpretation. The aim of the research was to determine the way the users who have been confronted with a satellite image on the Internet or on television since their early childhood are able to interpret aerial photographs and satellite images in true or false colours. The research participants—378 pupils and students aged 11, 15 and 19—dealt with spatial tasks in various types of images and maps. The differences in the success rate of problem solving based on the type of source image (a map—an aerial photograph, a satellite image in true colours, a satellite image in false colours) were measured. The success rate was compared by age and gender of respondents. The students and pupils were asked about their subjective evaluation of difficulty concerning the reading of various types of image data, about their personal preferences that influenced their selection of a map or image as the source of information. The study found evidence which subsequently opened up some ideas for follow-up research: (a) pupils work successfully with satellite and airplane map and image data; their success rate varies over the years (from 11 to 19 years of age) according to both—the documents (map, image) and the gender; (b) the pupil's subjective evaluation of the difficulty of working with image data does not correspond to objective success: the students subjectively consider working with satellite images in natural colours much simpler, yet they are objectively slightly more successful at solving problems in the pictures with unnatural colours (Potůček and Hošková-Mayerová 2017).

The main objective of the research was to compare the subjective assumptions of teachers with the subjective assumptions of pupils; then to compare the subjective assumptions of teachers with the objective results of pupils.

The research questions were compiled as follows:

1. How do the teachers and pupils evaluate the use of aerial and satellite photographs in the teaching process?
2. How interesting the work with aerial and satellite data is from the teachers and pupils' point of view?
3. Do the teachers' and pupils' subjective evaluations of the difficulty of working with aerial and satellite data match?
4. Do the subjective assumptions correspond to the objective results?

13.3 Survey Respondents

Two groups of respondents took part in the survey: teachers and their pupils. The teachers were represented by 24 primary school teachers certified to teach geography, including 13 males and 11 females. The structure according to the age of teachers and the length of their teaching experience in percentages is showed in Figs. 13.1 and 13.2. The teachers were asked about their college training concerning the work with aerial and satellite image data. 8 teachers said they had worked with aerial and satellite image data during their university studies, 2 teachers claimed they had never worked with satellite image data during their university studies. 11 teachers reported that they had worked with geographic information systems (GIS) during their university studies. School equipment can be considered very good: all the teachers can use the projector while teaching, 15 teachers use specialized geography classrooms. The distribution of schools by size

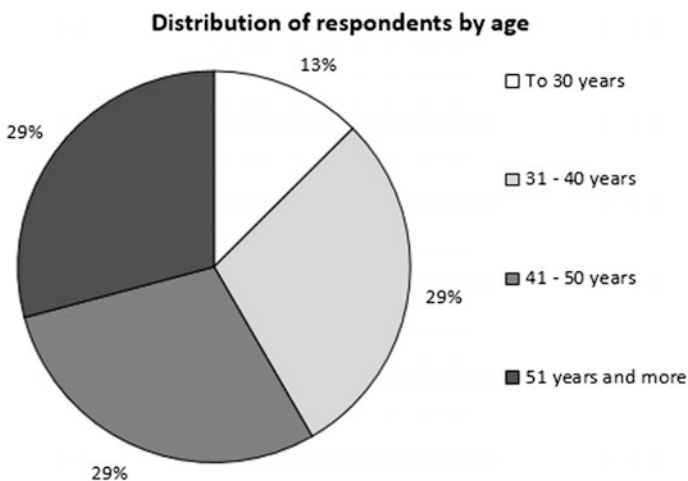


Fig. 13.1 Structure of teachers by age

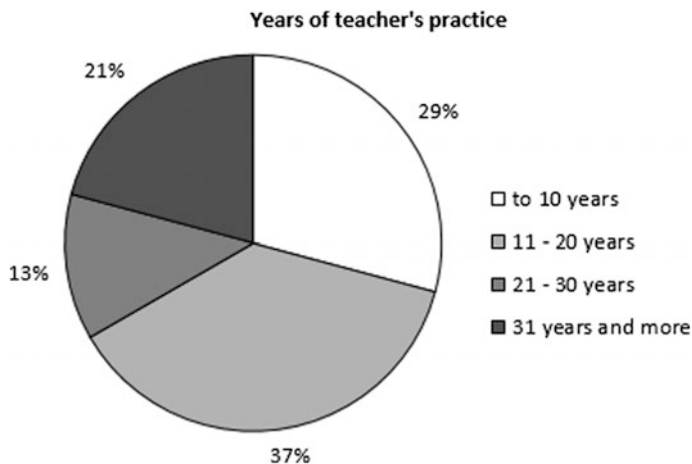


Fig. 13.2 Number of years of teachers' teaching experience

of municipalities was even: 6 schools in villages up to 5000 inhabitants; 8 schools in the towns from 5 to 50 thousand inhabitants; 3 schools in the towns from 50 to 100 thousand inhabitants; 7 schools in cities with over 100,000 inhabitants.

The second group of respondents were pupils and students aged 11 and 15. Overall 242 students were tested, of which 122 were boys and 120 girls. 108 children were aged 11 and 134 children 15. Pupils aged 11 and 15 were taught in eight classes in total (always two classes for each age group in the school).

13.4 Test Preparation

With regard to the questions of the research, a questionnaire for teachers, and a test and questionnaire for pupils were prepared. The questionnaire survey included questions related to the subjective evaluation of the difficulty of interpretation of aerial and satellite images and maps for both the teacher and their pupils. An example of the pupils' test was included. The pupils' test consisted of three main parts—the first part of the test contained *the tasks to evaluate the success of interpretation of aerial photograph and map data*, the second part dealt with *the evaluation of the successful interpretation of satellite images*, the third part of the test contained questions about the respondent's *subjective evaluation*. Thanks to the availability of images for both the respondents and the researchers, the images and maps available on the map server the Czech National Geoportal INSPIRE were used as the main source of image data. A cut from LANDSAT images provided by TopGIS Company was used to test satellite image data. From a range of options concerning unnatural colours of LANDSAT images, the combination 742 was chosen, which indicates water surfaces blue to black, watercourses blue, trees and

forests green, the fields in pink-green surface mosaic, built-up areas in purple-pink shades. The combination RGB 742 (Red, blue, green of channels 7, 4, 2) allows a very good resolution of water areas, watercourses and forests. The questionnaire survey and testing materials included the following material: a basic topographic map, scale 1:10 000, the image data: a vertical aerial image of resolution of 0.5 m; an oblique aerial image of resolution of 0.5 m, a satellite image in natural colours (LANDSAT 7, RGB 321), scale 1: 100,000, resolution 30 m, a satellite image in unnatural colours (LANDSAT 7, RGB 742), scale 1: 100,000, resolution of 30 m.

13.4.1 Course of Testing

The questionnaire survey among teachers took place in 2015; an interview and a questionnaire where the teacher assumed both positions of an interviewee and a researcher. School testing took place in 2013. The pupils and students were given written individual tests following the initial presentation of the test purpose and organizational instructions. The pupils were not limited in time; they dealt with the test for about 20 min on average. Unclear information was explained during the testing phase. The evaluation of the answers was with regard to the “paper” form of the test made manually. The test evaluation provided objective data concerning the pupils’ success rate. Figure 13.3 is a sample of a pupils’ test. The pupils worked with a vertical coloured aerial image showing the school surroundings: they were expected to identify selected objects and draw the required tasks in the image.

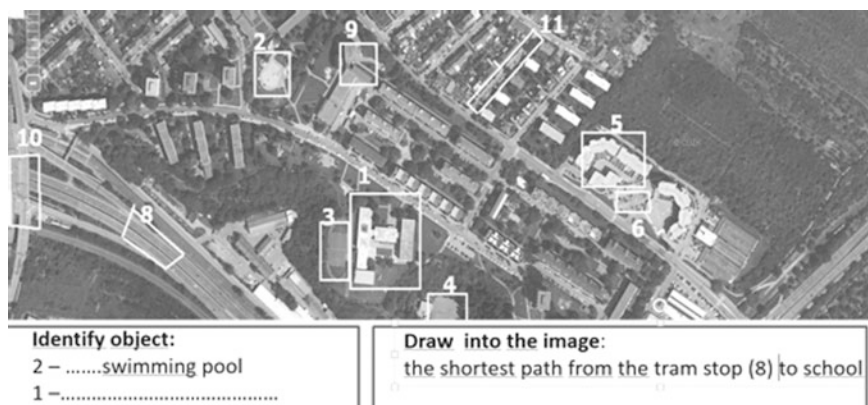


Fig. 13.3 Sample of a pupils test: The original test used a coloured aerial photograph

13.5 Results

In the first part of the test, in addition to the questions about the respondent's characteristics were the questions about the use of aerial and satellite image during the teaching process. The responses of teachers show that 88% of them use the teaching aids during the teaching process. A more detailed analysis of responses is shown in Table 13.2.

The pupils were asked whether they worked with aerial and satellite data during the classes. Both groups of pupils (aged 11 and 15) reported in about half the cases the answer "NO", i.e. they do not use the material concerning the remote exploration of the Earth. A more detailed analysis of responses is shown in Table 13.1.

A partial conclusion: the teachers claim they use the aerial and satellite image data. About 50% of pupils claim they do not work with the image data. However, the results may be distorted by the fact that the surveyed pupils were not the interviewed teachers' pupils—the survey was conducted with pupils in other schools.

Other questions for students and pupils pointed at their evaluation of working with aerial and satellite image data. A sample of the teachers' question: Do you think working with aerial and satellite image data is interesting for pupils? A sample of the pupils' question: Do you consider working with aerial and satellite images interesting? Specific results are given in Table 13.2. Most teachers think that work with aerial and satellite data is interesting for students, because they probably consider map and satellite servers attractive. The pupils reported more or less positive response in approximately 70% of cases, see Table 13.2. The pupils also said they viewed the aerial and satellite images in their free time (a) regularly (27% children aged 11 and 42% children aged 15) or (b) occasionally (42% children aged 11 and 37% children aged 15). Overall, around 80% of children work with such images in their free time, which demonstrates the attraction of interest of these documents and supports the teachers' evaluation results.

Table 13.1 The use of aerial and satellite photographs in the classroom—pupils

Responses:	11 year-old pupils/%	15 year-old pupils/%	Teachers/%
Yes, in detail	6	10	88
Yes, marginally	34	34	8
No	50	56	4

Table 13.2 How interesting the work with aerial and satellite data is from the teachers' and pupils' point of views?

Responses:	Teachers/%	11 years-old pupils/%	15 year-old pupils/%
Yes	71	33	29
Yes, but a little	17	38	44
No	12	22	19
I do not know	0	7	8

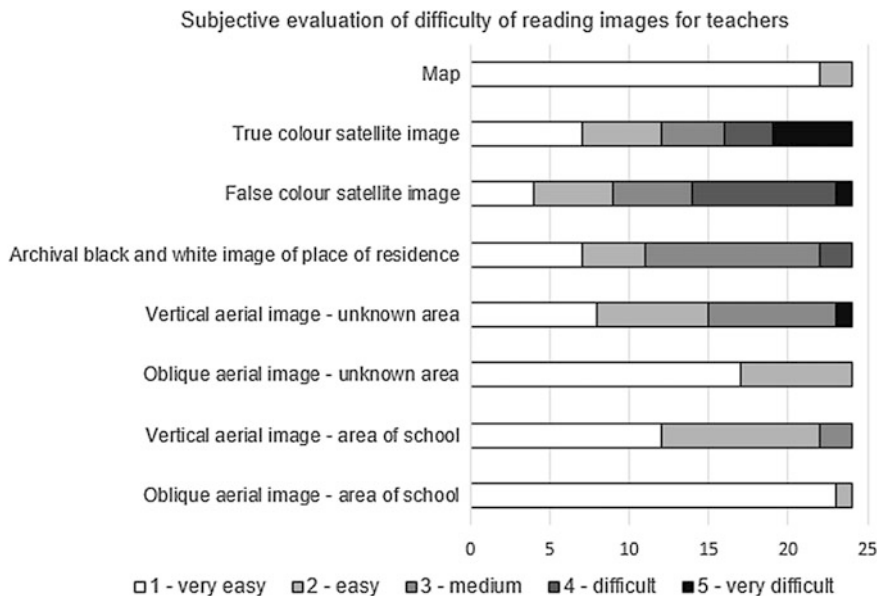


Fig. 13.4 Subjective evaluation of reading difficulty of viewed image from the teachers' point of view

Both the pupils and teachers evaluated aerial and satellite image using a scale of 1–5, where 1 represented the value of the simplest image type and 5 the most difficult type of image. For comparison, a map was also evaluated. The diagram in Fig. 13.4 shows that the most difficult satellite image was evaluated in its unnatural colours.

The teachers evaluated how difficult the reading of different types of aerial and satellite photographs for their pupils and for themselves might be. The teachers expected a higher level of difficulty when this image is used by younger children, the least difficulty when used by themselves. The easiest ones seem to be oblique colour aerial images, not maps, showing the school surroundings that, according to teachers, are easier to be interpreted by children.

Table 13.3 shows the teachers' evaluation of particular types of aerial and satellite images read by themselves and their pupils. For the gained data a correlation was calculated; the correlation coefficient of 0.90 shows a strong link between the assumptions of image difficulty for themselves (teachers) and for pupils.

The pupils evaluated the difficulty level of selected aerial and satellite image data for themselves. Also the value specified by teachers is inserted in order to make the results clearer. The correlation coefficient between the pupils' and teachers' evaluations is 0.75. The teachers and pupils coincidentally suggest that an oblique aerial image is the easiest one to be interpreted. The evaluation of results concerning the subjective pupils' and teachers' assumptions is presented in Table 13.4.

Table 13.3 The teacher's subjective evaluation of the difficulty level of reading aerial and satellite image data

The teacher's subjective evaluation of the difficulty			
Image	For 11-year-old pupils	For 15-year-old pupils	For teachers
An oblique coloured aerial image—school surroundings	1.63	1.33	1.04
A vertical coloured aerial image—school surroundings	2.25	1.71	1.58
An oblique coloured aerial image of an unknown area	2.46	1.67	1.29
A vertical coloured aerial image of an unknown area	2.88	2.38	2.13
An archival black and white aerial image of the residence place	3.54	2.67	2.33
A satellite image in unnatural colours	3.54	3.04	2.92
A satellite image in natural colours	3.21	2.54	2.75
Map	2.00	1.50	1.08
Average evaluation	2.69	2.10	1.89

Table 13.4 Subjective evaluation of the difficulty level of reading aerial and satellite image data

The pupil's subjective evaluation of the difficulty	11 year-old pupils	Teacher: for 11-year-old pupils	15 year-old pupils	Teacher: for 15-year-old pupils
An oblique satellite image in natural colours	1.75	1.63	2.14	1.33
A vertical satellite image in natural colours	2.37	2.88	2.14	2.38
A satellite image in natural colours	2.88	3.54	2.38	3.04
A satellite image in unnatural colours	3.54	3.21	3.04	2.54
Map	2.28	2.00	2.04	1.50
Average	2.56	2.65	2.34	2.16

The pupils were also tested on how successful they are in problem solving tasks when using map and aerial and satellite image data. Although the expected difficulty level of reading satellite image in unnatural colours was very high, they were objectively successful—see Table 13.5. Contrarily, working with maps was more difficult for pupils than reading aerial and satellite image data. The objective success rate demonstrates a shift in the success rate of children with regard to age—pupils aged 15 are more successful than younger classmates.

Table 13.5 Objective success rate of pupils

Objective success rate of pupils	11 year-old pupils (%)	15 year-old pupils (%)
Map	53	70
A vertical coloured image	71	80
A satellite image in true colours	69	83
A satellite image in false colours	74	89

13.6 Conclusion

The study focused on teachers' and students' attitudes concerning the teaching process, teachers and students' assumptions concerning the work with selected resources. The aerial and satellite image data that have lately appeared in the teaching process was used in the survey evaluation process. The pupils and teachers evaluated how interesting these resources are, how difficult it is to work with them, and their actual use in the teaching process. The pupils were given a test concerning the work with aerial and satellite image data, from which the objective data on the pupils' progress rate was obtained. The following conclusions are based on the respective research:

- (1) There is a difference between the teachers' and pupils' evaluations of the use of aerial and satellite image data during the teaching process. About 50% of pupils say they do not use the image during the teaching process. Only 4% of teachers said they do not use the image data.
- (2) The teachers and pupils agree that the use of aerial and satellite image data is interesting. Pupils also use them in their free time. The teachers expect the respective teaching resources to be more attractive than the pupils, while the pupils are more reserved in the relation to these resources.
- (3) The teachers assume that working with aerial and satellite image data is less difficult for themselves than for their pupils. The teachers also take into account pupils' ages—they assume the image data understanding is more difficult for younger children. The assumption concerning the difficulty for teachers themselves strongly correlates with their assumption concerning the difficulty for their pupils. The research shows that it is necessary to influence the teachers' training—if we want the teachers to use certain teaching aids, they should not consider them of a great difficulty for their pupils.
- (4) The pupils and teachers agree on assumptions concerning the difficulty of working with some teaching aids. This is particularly evident in the images in unnatural colours. The data to be further researched is whether the evaluation concerning the terms of "natural" and "unnatural" colours would achieve different results. The authors' experience in teaching students—the future teachers—shows that the term "unnatural" commands students' respect—a concern that the work will be of great difficulty.
- (5) The subjective assumptions concerning the difficulty of image work is fundamentally different from the objective results (As proved research

Řezníčková et al. 2013). Although the pupils and the teachers had expected considerable difficulty in dealing with satellite image data in unnatural colours, the pupils reached the highest success rate. The colour combination of unnatural colours was chosen deliberately, so that e.g. water (rivers and ponds in the image) was blue. In the Czech Republic, the natural colour of water in rivers is mainly brown-green and in this colour it is displayed in images with natural colours. The pupils, however, encountered a problem in finding rivers and ponds with such colours in the images. They were much more successful in reading images in unnatural colours, where they used not only the anticipated—and learned skill concerning such colours in maps (bright blue) but also contrasts in relation to the surroundings. The testing showed that the use of unnatural colours when reading satellite image is reasonable when being used by laymen.

The teachers' faith and belief in the success of their pupils is in general, according to many studies (e.g. Minor 2002, Řezníčková a kol. 2013), an important part of teachers' attitudes and values that apply in teaching. The teachers' approach influences the development of reading skills concerning aerial and satellite image. Active teachers' approach, their corrections, and interpretation clarifications of a particular image including the pupils' work evaluations is positively reflected in the results interpretation. The development of cartographic skills varies not only with age, but also with pupils' practice and teachers' support (Hanus and Marada 2014, 2016).

The presented study is a contribution to the research of attitudes and values applied by teachers in the teaching process, and to a comparison of the assumptions and their objective results.

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