PEDAGOGICAL EVALUATION OF THE PLATFORM BASED ON AUGMENTED REALITY TECHNOLOGY: A POSITION OF THE EXPERTS PROVIDING ASSISTANCE WITH TEACHING/LEARNING

Margarita Vilkonienė, Vincentas Lamanauskas, Rytis Vilkonis
Siauliai University, Lithuania
E-mail: vilkarita@yahoo.com; v.lamanauskas@ef.su.lt; vilkonis@yahoo.com

Abstract

The primary purpose of the progressing international scientific project ARiSE[1] – is to test pedagogical effectiveness introducing augmented reality (AR) into the classroom and creating remote collaboration between classes around the AR display systems. ARiSE will develop an AR platform and associated pedagogical use cases, enabling teachers to promote, with a moderate effort, new teaching practices for teaching scientific and cultural content in primary and secondary school. The aim of the project is to offer to the group of students the possibility of 'playing' with virtual objects and thereby to perform learning by doing instead of learning by reading.

The research was carried out at Siauliai University in Lithuania. 38 respondents - experts assisting students with special educational needs in teaching/learning (psychologists, speech therapy experts, special pedagogues and the specialists from the education department) took part in this research. The focus groups were formed requiring indiscretion i.e. the group members were not allowed to make any specific impact on one another (in terms of work place, competence and social status). Thus, 6 groups of respondents were set up.

Key words: *pedagogical evaluation, focus group, qualitative research, augmented reality.*

Introduction

The challenges of the 21st century make corrections to understanding public changes and human being. Innovations are defined as an expression of commonness whereas human being has associations with lifelong learning. Thus, school plays a crucial role in public life as exactly this educational establishment is responsible if the young generation goes to universities and work places ready to individually work and study in the overloaded world. E. Martišauskienė suggests that in order to pursue qualitative public education, a major point is envisaging the opportunities of people with special needs to become actively involved partners who '*can offer even more and better than those who are physically fit and mentally capable*' (Martišauskienė, 2005, p. 126). The problem dealing with social integration of persons with certain disabilities and special needs into society arises in the context of alterations of modern civilization and creates the need for reducing social isolation of the above mentioned people assisting them with successful socialization in the public. Therefore, a

1 This research is carried out within the frames of international FP6 scientific project "ARiSE", http://www.arise-project.org

valid point is that all children including physically fit, mentally capable and having certain disorders should be trained together and that kids in good health and those with special needs should develop all their strengths helping each other and making new possibilities. A. Galkiene (2003) accepts that integrated training could be understood as the meeting of persons with different abilities and possibilities of being involved in certain activity to carry on systematically built learning activity aimed at self/education purposes supported by partnership. In this case, training is based on national and international laws and regulations on equal all persons' possibilities of receiving good education, applying it for students' abilities and needs (Education for All, 2007; Millennium Development Goals, 2007; United Nations Literacy Decade, 2007). Social integration highlights a strategy that can be implemented in two ways:

to help a person with special needs in adapting in the social environment;

to improve environmental conditions in order to ensure successful personal functioning (Marti auskienė, 2005; Raudeliūnaitė, 2005).

A discussion on improving the learning environment reveals that it should be worth emphasizing the most important present object debated by the pedagogical and scientific society which is equipping school with information communication technologies. Applying these technologies in the educational process is **the main direction of modern education** (Slabin, 2002). A secondary assessment of 3500 research results on applying ICT for educational purposes carried out by the Software & Information Industry Association (2000) and international SITES research (2001) revealed that **the use of ICT in the educational process had a positive impact on the learners of different age groups, the students with ordinary and special needs dealing with different subjects**. However, pedagogical practice illustrates that purposeless and unprofessional relation with computer equipment increases teachers' time expenditure whereas the abundance of technical equipment troubles schoolchildren and decreases their work efficiency (Samuolienė, 2007). Such situation makes a negative impact on teachers' motivation for a more frequent ICT application in the classroom. Moreover, the use of ICT for educational purposes is not extremely positively evaluated. So far, **a sceptical and careful attitude to employing computer for teaching/learning purposes has existed**. A part of teachers are tend to feel uneasy that due to intensive and long-lasting work at computer and because of constant need for receiving the latest information, inter-communication between people can be reduced and lead to the dissolution of society (Balčytienė, 1997). The international research on the use of ICT for science education disclosed that the students also would prefer the real learning environment or combine real and virtual environments. Only a minor part of the surveyed comprehensive school students should agree on using the virtual learning environment (Lamanauskas, Vilkonis, 2007).

The latest scientific research shows that along the real and/or virtual teaching/learning environment, a combined environment can also be acceptable. The introduced environment can be created using **augmented reality technology** (ART) i.e. augmenting real objects found in the environment and usual material visuals with virtual information in the real space. M.Adams (2005) states that augmented reality technology is one of ten most important human technologies that should be very useful for learning. The systems of augmented reality are completely new types of links between the users. Augmented reality is created putting into practice the display of a computer which affects the user's senses and provides additional information. A virtual view or text can be inserted into the vision field of the user. Nevertheless, information can be received through other senses such as hearing or touching. Thus, the core of augmented reality is formed from the visuals that can be observed adopting a special devise (for example, stereo glasses are used for watching a view through the semi-clear screen). The final result of such observation is the wholeness of real and virtual information. Currently, applying different approaches, a number of various AR technologies have been created. In order to examine the possibilities of using ART for learning purposes in comprehensive school, in 2006, the ES 6FP project ARiSE (Augmented reality in School Environments) was launched. The technology produced by the ARiSE project is aimed at creating conditions for the users not only to observe a combined view but also to directly interact with the real world (real objects). It is likely that in this case, the approach *learning by doing* can be implemented in a more effective way.

A prototype of the new learning platform *The Human Digestive System* based on ART and focusing on teaching/learning biology was created in the first year of work on the project. In 2007, a group of scientists from the University of Siauliai conducted research focused on how the teach-

ers of sciences evaluated the efficiency of a lately created teaching/learning platform based on augmented reality technology and the real conditions of implementing the technology in school environments. The investigation established that if applied at school, the ARTP (augmented reality technology platform) could make the learning process of different target groups more effective and help the gifted learners and those with low motivation and special educational needs (Vilkonienė, Lamanauskas, Vilkonis, 2007). Moreover, research revealed that a part of teachers believed that when using the ARTP students with learning difficulties should treat the learning process as a game and therefore find studying easy and attractive. The respondents suppose that the latter probability is a great advantage of technology. Such hypothetical respondents' propositions are confirmed by the results of the undertaken research: applying didactical games in the classroom offers students a possibility of acquiring knowledge in an acceptable way and assists with developing learners' thinking and ability to be actively involved that is very relevant to students with special educational needs (Malonaitienė, 2004).

The investigation is aimed at how the experts assisting students with special needs, different disabilities and disorders evaluate the efficiency of the recently created ARTP and the real conditions of implementing and applying the platform under school conditions.

Research Methodology

Research was carried out in October 2007. As ARTP is still in progress and the issues of its application in school environments are not carefully investigated, a **quality-based** study was conducted to receive more accurate information.

Although similar investigations have two characteristic stages of respondent sampling (sampling an area or place where a phenomenon is researched and sampling inside the area/place), due to research specificity (a completely new phenomenon is researched, presently, no place of phenomenon occurrence has been established), area or place sampling has not been accomplished. Research took place at the laboratory set up in the research centre of science education at the University of iauliai, Lithuania. Research specificity and phenomenon newness were the reasons for refusing to follow the requirement that research should be undertaken in the natural environment. There is no school in Lithuania having the teaching/learning platform based on augmented reality technology, and therefore no possibilities of investigating the expression of the latter phenomenon in comprehensive school exist.

To receive relevant information, **target sampling based on certain criteria** was applied. The basic criterion of the above mentioned sampling is

- experts assisting students with special educational needs.

Considering various learners' disorders and disabilities, the scientists specializing in this area and practising pedagogues as the experts in the field were supposed to objectively evaluate the qualities and drawbacks of the teaching/learning platform based on augmented reality technology and to schedule the real possibilities of implementing and applying this technology in schools. The introduced criteria determined limited scope of research which suffered from lack of typical information. In order to avoid this problem, a systemic sample of typical examples was carried out. Thus, scientists, psychologists, speech therapy experts, special pedagogues and the specialists from the education department were involved in the carried out study.

The principle of volunteerism and ethical requirements were followed along the conducted research. The respondents who voluntarily accepted the invitation to have a look and evaluate the teaching/learning platform based on augmented reality were involved in the inquiry. Phone calls and the Internet were used to contact the respondents in order to arrange the time of meeting.

Non-standardized interviewing of focused groups was applied to collect the surveyed data. The method was applied due to its potentiality to speedily receive a large amount of relevant and accurate information on the issues and possibilities of using the teaching/learning platform. The problems are primarily identified by the teachers dealing with pedagogical practice. To obtain highly accurate information on the issues important to the teachers, **a type of the half-structured interview** was applied i.e. an interview was held following the pre-constructed scenario considering questions

offered by a specially trained person to the small groups of the respondents. The questions focused on 4 topics relevant to the researchers:

- general evaluation of the ARTP;
- qualities and drawbacks of the ARTP;
- possibilities of applying the platform in schooling practice;
- applying the ARTP to students with different special needs.

To generate original ideas or possible decisions on intriguing issues on the basis of interaction between experts in a group, certain questions were revised, specified and repeated; new questions not included in the scenario were sometimes asked. Seeking a more natural researching environment and an in-depth and immediate discussion, question sequence was not observed and the interview procedure was not shot or recorded. The received information was saved in a written form. As it was mentioned above, the discussion was lead by an experienced moderator who was not involved in exploring the issues within the interview but acted as a moderator and adviser. From the very beginning of the interview, the moderator felt competent to notice wording close to the surveyed respondents and communication method; the made remarks were successfully adapted along the interview so that the relevant topic should be considered in an appropriate way.

The focus groups were formed requiring indiscretion i.e. the group members were not allowed to make any specific impact on one another (in terms of work place, competence and social status). Thus, 6 groups of respondents were set up; one of those was joined only by the scientists from the University of iauliai; the other groups involved from 5 to 9 members where the respondents hardly knew one another and in the majority of cases, worked in different schools of the same region.

The surveyed participants had been introduced the ARTP. The latter activity included two stages. Stage 1 theoretically presented the forms of applying augmented reality technology in different fields of public life; the respondents were briefly made known a newly produced ARTP. Stage 2 offered the teachers the possibility of applying the ARTP in practice clearly identifying its qualities and drawbacks.

A quality-based data assessment was carried out under the methodology of Strauss A. and Corbin J. **employing the codification of three stages**. Stage 1 is an open codification procedure including the initial identification of the notional parts. Considering the specified topics, the obtained data was combined into the concepts and fell into single categories. At a later stage, **the data was analyzed inside each of the categories** i.e. central codification establishing the characteristics of the categories was performed. References to the specificities of child development and to the evaluation of special educational needs made by A. Ali auskas (2002) were considered distinguishing the subcategories of the propositions. Stage 3 concentrated on selective codification elaborating relationship between categories. As in the majority of cases the researched data is rather specific (statements on different groups of disabilities and disorders of students with special educational needs), in order to avoid possible mistakes of data assessment, along the process of central codification, the scientists from the Department of Social Welfare and Disability Studies of iauliai University were asked for advise.

Any phenomenon can be analyzed using different methods, and therefore the standardization of quality-based data assessment was avoided (Židžiūnaitė, 2001). Though the researched data shows the discovered underlying tendencies, however, the researchers believe that there is no point to put emphasis on the exact number of cases.

Characteristics of the Respondents

38 respondents - experts assisting students with special educational needs in teaching/learning (psychologists, speech therapy experts, special pedagogues and the specialists from the education department) from comprehensive schools of Šiauliai, Panevėžys and Kretinga located in the city site and regional centres, Panevėžys special boarding school and Kretinga Department of Education participated in research. One of the focus groups was formed from the scientists working in the Department of Social Welfare and Disability Studies at the University of iauliai. The majority of the respondents were female (33), the rest – were male (5).

Results of Research

The result of open data codification – the distinguished general notional **topics** of the interview:

- general evaluation of the ARTP based on augmented reality technology;
- respondents' information and practical experience having impact on the evaluation of the ARTP;
- qualities of the learning platform based on augmented reality technology;
- drawbacks of the ARTP;
- evaluation of the ARTP in terms of other training aids;
- possibilities of using the ARTP in schools;
- ARTP application to students with different needs.

The respondents' description of the first impressions of a new ARTP points to the platform as good and interesting. The discussions positively evaluated the idea of the instructional tool (*the idea is brilliant and can and need be used*). At least 4 groups from 6 stressed that ARTP was a new and therefore intriguing instructional tool and schools *were always interested in innovations*.

The debates also disclosed single negative evaluations named by the respondents as at the very beginning, negative emotions were generated by the constructions of the ARTP. It sounds disappointing having perceived that the ARTP is a perspective of the distant future requiring massive financial investment. The size of the ARTP was one of the factors that stimulated a feeling of dissatisfaction. One of the respondents summarized his evaluation: *I don't like the platform*.

A more detailed data assessment illustrates that the effect of the first superficial impression made impact on the respondents' disappointment. The debates revealed motivated respondents' evaluations, the constructive ideas of problem solving were offered, provisions were made. It was agreed that the ARTP would be improved in the future.

Individual respondents' propositions emphasize the effect of unexpectancy; however, they do not underline neither positive nor negative evaluation of the ARTP. Therefore, depending on the meaning, the above introduced proposals fall into the category of *neutral evaluations*. A general evaluation of the ARTP is shown in Table 1 (propositions motivating the content of the categories are presented in the annexes).

Table 1. A general evaluation of the teaching/learning platform.

Categories	Subcategories	Summarized propositions
Positive evaluations of the ARTP	Useful tool	ARTP based on augmented reality is a good idea and is worth being implemented in practice
	Innovative tool	ARTP innovativeness is emphasized. New technologies are required in schools.
	Interesting tool	ARTP is an attractive tool. The respondents felt engaged.
Negative evaluations of the ARTP	Material resources	Negative emotions experienced due to the expected price of the platform were named.
	Perspectives of distant future	ARTP implementation in schools is a very distant perspective. Perceiving the situation shows negative emotions.
	Construction	The size of construction negatively influenced the first impression – it is too cumbersome.
Neutral evaluations	Impact made by the effect of unexpectancy	ARTP was found an unexpected teaching/learning tool; however, neither positive nor negative evaluations were not specified.

The elements of the respondents' propositions illustrate that despite certain disappointment due to ARTP, the introduced platform in the majority of cases received positive evaluations. Negative emotions could be influenced by lack of information on augmented reality technology and on a new-created tool for teaching (*the concept 'augmented reality was new for us, we didn't read and didn't hear anything about that*) as well as by wrong visualization of certain concepts (see Table 2). The above mentioned visuals were determined by the associations formed by the concept 'technology' (*the invitation to an organized event included the word 'technology', so we supposed some modern information communication technology would be discussed*). It was expected to see something similar to an ordinary computer and to get acquainted with new educational software devoted to students with special needs. The respondents were disappointed by the real picture of the ARTP constructions as they were not expecting to see anything similar.

The positive respondents' propositions can be explained by the situation that the experts assisting with educational help have no work and experience of using information communication training aids. The majority of participants fully agreed that special pedagogues were not provided with the possibility of applying even the simplest information communication technologies (see Table 2). Thus, despite certain reservations, a perspective on having a modern educational tool - the ARTP based on augmented reality - looks very attractive

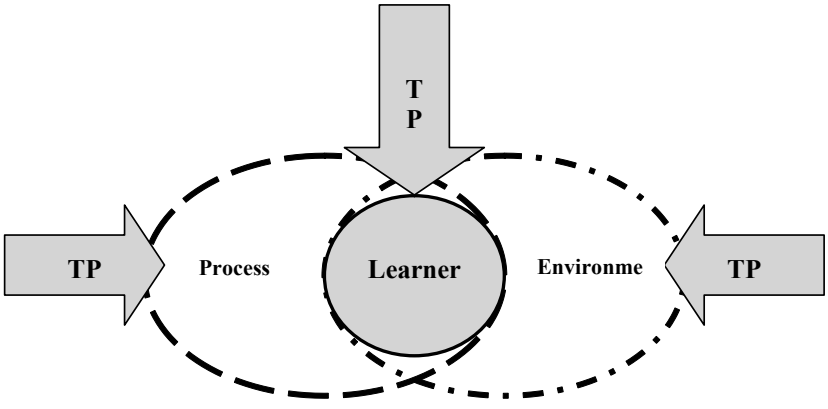
Table 2. The evaluation of the platform under the influence of practical experience and available information.

Categories	Subcategories	Summarized propositions
Available information	Lack of information	No information on augmented reality technology was available, the concept 'augmented reality' didn't develop any visuals
	Fixed visuals	Due to the impact of the concept 'technology', it was expected to see something similar to an ordinary computer and to get acquainted with new software.
Practical experience	Lack of opportunities tom use IT	Special pedagogues in schools have no possibilities of using even the simplest information communication technologies. When training the students with special educational needs, chalk, black board, the same posters and verbal instructional aids are most frequently used.

Close attention was paid to discuss **the qualities** of the ARTP (Tables 3, 4 and 5). Depending on the above mentioned topic, data assessment distinguished 3 categories of propositions:

- student-centred qualities;
- qualities aimed at the process of teaching/learning;
- qualities aimed at the learning environment.

It must be emphasized that the latter data distribution is rather provisional. A learner as a subject of teaching/learning is an active participant of the teaching/learning process which takes place in a particular environment. The learner, process and environment are obviously interconnected. The ARTP as a teaching tool simultaneously makes impact on both the learner and the environment and vice versa (see Picture 1).



Picture 1. The impact fields of the learning platform based on augmented reality (AR).

Considering a semantic feature, all elements of the propositions in category 1 (student-centred qualities) fall into 5 subcategories:

- possibility of individual teaching/learning;
- possibility of communication and collaboration;
- possibility of independent learning;
- fostering positive emotions;
- encouraging motivation for learning (see Table 3).

The discussions revealed that the experts offering educational support found the possibility of making the teaching/learning process individual relevant (*it should be an excellent chance of making the educational process individual; the quality is the possibility of independent learning*). Three focus groups completely agreed that the latter possibility was one of the most outstanding qualities of the ARTP. Such pedagogues' attitudes were determined by the specificity of practical work with students having special educational needs as in the majority of cases, this work was individual. One of the focus groups thoroughly debated individualization of students with special educational needs and underlined the student's possibilities of working at optimal, individually accepted pace, listening to the same information several times and repeating the same information.

It's worth mentioning **the possibility of communication and collaboration** which is a distinguished quality of the ARTP. During recent decades, the ideas of teaching through collaboration have reached the teachers from different sources including educational literature published in Lithuania and abroad, teacher training courses and universities from the west. These ideas are emphasized by Lithuanian documents on education. Therefore, it is clear that the teachers find the possibility of organizing the processes of communication and collaboration imposing. Moreover, the possibility of communicating with the students of a distance learning class was noticed: communication is available not only with those sitting next to you; *microphone and Scype should open up a possibility of contacting a distant person*.

The evaluation of the ARTP suggested the possibility of independent learning to students with special educational needs (*the possibility of independent learning and making individual decisions can also be treated as a quality*). Self-sufficiency and ability of making individual decisions and the possibility of increasing learning motivation working at ARTP are the high qualities of modern society, and thus the advantage of the ARTP should be devoted close attention. On the basis of practical experience, training experts asserted that *students with special educational needs were not interested in studying and their level of motivation was low*. Positive motivation for learning is ensured by examining specified examples and completing tasks on the topic directly related to teaching/learning. It is clear that along the use of the ARTP, very specific tasks directly related to the topic are presented, and thus the ARTP could become an effective alternative to classic learning i.e. it should create conditions not only for knowledge acquisition but also should involve the students into active motivated learning activity.

The interview expressed an opinion that work at the ARTP would show positive students' emotions. Though it was the only opinion, hypothetically, this quality will make impact not only on a student but also on the quality of the learning process and learning environment.

Table 3. The evaluation of the teaching/learning platform. Qualities.

Categories	Subcategories	Summarized propositions
Student-centred qualities of the ARTP	*Possibility of individual teaching*	The quality of the ARTP is the possibility of individual teaching/learning considering the needs i.e. the possibility of work at optimal individual pace; the possibility of repeating the same task a number of/a few times if necessary; the possibility of listening to the same information several times.
	Possibility of communication and collaboration	Extra options of the ARTP (microphone) and access to the Internet should allow communicating not only with those sitting next to you but also with the students of a distance learning class.
	Possibility of independent learning	One of the ARTP qualities is the possibility of independent learning and making individual decisions. It is highly relevant to integrating the students with special educational needs into modern society.
	Encouraging motivation for learning	The ARTP is a tool increasing a low level of motivation of the students with special educational needs. The platform will provide an opportunity to be actively involved into the process of teaching/learning even when the material of the taught subject is not clear.
	Fostering positive emotions	Work at the ARTP will foster students' positive emotions.

The evaluation of the ARTP showed certain qualities aimed at the process of teaching/learning:

- possibility of developing creativity;
- possibility of solidifying knowledge;
- possibility of receiving feedback information;
- stimulates interest;
- facilitates the teaching/learning process.

Only few propositions can attributed to the above mentioned category. The majority of the ARTP qualities aimed at the process of teaching/learning were identified by the scientists from the University of Siauliai. The possibility of developing students' creativity was accepted as one of the most outstanding qualities of the ARTP. The propositions of a similar format are put forward on the basis of performing the tasks of lesson prototype 1 which is in the majority of cases, offers a few options and becomes a stimulus to think and behave creatively (*the elements of creativity exist – a learner can try to find a correct answer in one or another way; in the event of a few options, there will be some space for creative work*). The assessment of the researched data suggests that in this case, the respondents treated creativity as a thinking method when thinking and imagination are closely connected i.e. thinking invokes creative imagination and then, a new quality - creative thinking – appears. The latter one can be developed through education and problem solving.

Another quality of the ARTP is the possibility of receiving feedback information on individual progress. Thus, self-control is encouraged and developed, the possibilities of repeating the task as many times as required are created until the necessary result is achieved.

The favourable possibilities of broadening and consolidating knowledge were mentioned by one group of the respondents. Moreover, in single cases it was mentioned that the ARTP would increase students' interest in the process of teaching/learning and facilitate acquisition of educational, material (see Table 4).

Table 4. The evaluation of the teaching/learning platform. Qualities.

Categories	Subcategories	Summarized propositions
Qualities of the ARTP aimed at the educational process	*Possibility of developing creativity*	Along the process of performing tasks, the possibility of choosing a decision exists which creates the conditions of developing students' creativity.
	Possibility of solidifying knowledge	The possibility of broadening and solidifying knowledge was mentioned.
	Possibility of receiving feedback information	Feedback information on individual progress is provided; the students are encouraged to repeat the task until the wanted result is achieved.
	Possibility of stimulating interest	ARTP is an efficient method to make the teaching/learning process more diverse. The variety will increase students' interest in learning.
	Possibility of facilitating the process of learning	The possibility of facilitating the teaching/learning process was envisaged which is very relevant to the students with special needs.

The category of qualities aimed at the educational environment falls into 6 subcategories:

- interaction with a real environment;
- picturesqueness;
- 3 dimensional medium;
- possibility of receiving simultaneous information through a few senses;
- possibility of compensating drawbacks caused by different disabilities and disorders;
- concentrated educational information is provided (see Table 5).

It's worth mentioning that interaction with a real environment as a quality of the ARTP was named by the scientists from the University of Siauliai only. The data assessment discloses a total agreement of the above mentioned focus group on the position that there is no purpose of learning only in the virtual environment as it is necessary to be in the close relation with the real environment (*if children learn only in the virtual space, there is a danger that knowledge won't be transmitted to reality. If the organs of digestion are seen in the virtual space only, they will be visualized in a similar way. Thinking of a child will remain in the virtual space*).

The respondents' forethoughts to the picturesqueness created by the ARTP is a contrary situation to the one introduced before. The surveyed participants of all 6 groups accepted the latter quality of the ARTP as the main advantage. Such attitude is based on the work specificities of students with special educational needs. These learners have difficulties with abstract thinking, they need special picturesque educational material which is according the respondents can be offered by the platform.

Concentrated information was another quality of the ARTP noticed by one of the groups. Although due to lack of propositions, an assessment of this sub-category does not point to any of the possibilities of drawing precise conclusions, yet it is supposed that when discussing **concentrically** presented information the respondents supposed that educational material through the ARTP was briefly introduced following **the clearly formulated principle.** Information is briefly introduced. Audio information is supported by visualization including symbols, colour sharpening and blinking of certain objects. To train students with special educational needs, the possibilities of the ARTP of compensating drawbacks caused by certain health disorders or disabilities and the opportunity to receive simultaneous information through a few senses should be extremely favourable. The latter respondents' idea can be based on the science of psychology showing that cognition of reality starts from senses. Thus, while transforming educational information, affecting different senses is particu-

larly important as in this case, sight, hearing, motorics, smell, taste and touch play a crucial role. These senses help with creating clear visuals in the consciousness, some of those are used for abstract concepts. It is highly significant to the younger students. As the students with special educational needs are considered, the maturity of a great majority of those certainly is slowed down comparing with their fit partners. It is supposed that that despite the age of the learners, the process of educating the above described students should actively stimulate as many different senses as possible.

Table 5. The evaluation of the teaching/learning platform. Qualities.

Categories	Subcategories	Summarized propositions
Qualities of the ARTP aimed at the teaching/learning process	*Interaction with a real environment*	A quality of the ARTP is a remaining connection to a real environment creating optimal conditions for transferring an individual knowledge into reality which is difficult to be achieved learning into an exceptionally virtual space. Moreover, the connection to reality will facilitate the perception of educational material.
	Picturesqueness	Picturesqueness is a distinctive quality of the platform. This feature is very relevant to students with special educational needs as it opens up possibilities of developing abstract thinking, seeing hardly visible phenomena or objects (for example, the formed layers of the X object).
	3 dimensional medium	The 3 dimensional medium will stimulate perception and thus it is a quality of the ARTP.
	Possibility of receiving simultaneous information through a few senses	A valuable quality is that simultaneous learning involves at least a few senses: sight, hearing and touch. That's why information can be better accepted. None of technologies can offer similar possibilities.
	Possibility of compensating drawbacks	A great quality is that the platform should create strong possibilities of studying certain subjects (to gain a required amount of knowledge) and to compensate different defects that cause special educational needs.
	Concentrated information	All information on education is provided on a very concentrated basis.

It is natural that after the ARTP had been applied in practice, the respondents noticed both the qualities and drawbacks of the platform. The drawbacks also felt into 3 categories considering the same limitation that all 3 presented fields of ARTP impact were closely related (see page 5).

- student-centred drawbacks;
- drawbacks aimed at the process of teaching/learning;
- drawbacks aimed at the teaching/learning environment.

While discussing the drawbacks of the first category, a forethought contradicting the one presented in Table 3 was made - the ARTP will not increase motivation for learning and will not support an idea of active learning. The respondents suppose that students with special educational needs will be involved into game activities at best, a number of elements of which can be found working at the platform. One of the groups discovered a non-defined drawback aimed at the process of teaching/learning: *the process of learning is complex* (see Table 6).

Table 6. The evaluation of the teaching/learning platform. Drawbacks.

Categories	Subcategories	Summarized propositions
Student-centred drawbacks	*ARTP will not motivate the students to learn*	It is supposed that the use of the ARTP and game elements will put into the shade learning activity i.e. students with special educational needs will treat activity as a game ('will try to catch' the arrows); however it won't be learning. Some of the learners are not tend to be actively involved and when working at the platform can become only passive observers of their class mates.
Drawbacks aimed at the process of teaching/learning	*Complex process*	Work at the ARTP is rather complex.

The largest number of the drawbacks of the ARTP was noticed and aimed at the teaching/learning environment (see Table 7). Such situation can be explained by the fact that this educational tool is still in progress. The existing construction of the ARTP is the first project, and thus it is supposed it will change and be more advanced. The majority of groups stressed that space was too much impacted inside the construction and therefore certain disadvantages arose: *not enough space in the platform itself: uncomfortable seating and getting off; work place is uncomfortable; the head stumbles over the platform trying to have a seat*. Due to 'ergonomic drawbacks' the introduced respondents' propositions relate to those falling into the category 'the construction is too cumbersome'. However, a detailed data assessment showed that a semantic meaning of the latter statements attributed to these categories differed. The propositions of the first category 'ergonomic drawbacks' talk about too limited and rather impacted space inside the construction. Other statements (*The construction is too cumbersome*) refer to the frame holding all equipment and find the construction *too cumbersome, using much space and causing discomfort*.

Tricky operation is another burning problem disclosed by the evaluation of the ARTP. The data received from the interview show that the teachers-practitioners feel concern about real difficulties working at the ARTP and are worried over the problems of preparing the platform for work (to set and focus picture etc.). The discussions revealed constructive suggestions on how the ARTP should be advanced: centralized management (from one platform), a regulated pace of the performed tasks etc.

The question of a real object was considered. The experts assisting students with learning dissociated from the issue of the summarized real object and were not involved into a discussion of what particular object should be chosen as a topic of a lesson. The interview dealt with a specific model of the digestive system used for prototype 1. It was noticed that this moulage was insufficiently optimal to study the digestive system. The teachers did not like the size (too cumbersome) and position (horizontal) of the platform. One of the groups found out that the students with certain disabilities would have no possibilities of interacting with the object (will be not allowed to touch it, will not reach certain points etc.). (See Table 7).

Separate respondents' propositions had impact on distinguishing another two subcategories: '*The tool is too expensive'* and '*too distant perspective of the future'*. The aspects specified by the respondents were named as the drawbacks of the ARTP; however, similar propositions were carefully analyzed considering two reasons – first, only few propositions of a similar format were put forward (2 in each category), second, taking into account the pace of ICT development, the cost of the ARTP and future perspectives are very relative.

Table 7. The evaluation of the teaching/learning platform. Drawbacks.

Categories	Subcategories	Summarized propositions
Drawbacks aimed at the environment	Ergonomic drawbacks	A few drawbacks of the platform considering the ergonomic aspect were named: not enough space inside the construction, uncomfortable seating and getting off, the head stumbles over the frame of the construction.
	Inappropriate real object	The real object of prototype 1 (model of the digestive tract) is a drawback of the ARTP. The horizontal flat of the introduced model caused certain inconveniences: hard to observe the whole view of the model and to reach the required point.
	Complicated operation	Operating the platform is too complicated, not suitable for students with special educational needs. It's hard to prepare the ARTP for work. Suggestions on how to design curricula in order to regulate the pace of imparting information and completing tasks were made. Moreover, operating the platform should be centralized i.e. one computer (teacher's computer) should be used. It should help with simplifying and pushing forward the lesson.
	Too cumbersome construction	Students with special needs can feel uncomfortable working inn such cumbersome constructions. If the construction of the platform remained unchanged, it would be complicated to place the ARTP in schools.
	Tool expensive tool	In some cases, a really high cost of the ARTP was accepted as a drawback.
	Too distant perspective of the future	Too distant perspective of applying the ARTP in schools was also admitted as a drawback.

The data assessment shows that the evaluation of the ARTP in terms of other training aids took place in the context of individual experience. The experts of special education working in comprehensive schools compared the ARTP and other tools such as printed sources of information, educational software, educational films, posters and moulages used for training students with special needs. A part of the respondents made comparisons using the ARTP in terms of verbal training aids (interpretation) (Tables 8, 9 and 10).

- Considering the semantic meaning, all propositions fall into 4 categories:
- qualities of the ARTP in terms of training aids based on modern information technologies;
- qualities of the ARTP in terms of other training aids;
- qualities of other training aids based on modern information technologies in terms of the ARTP;
- qualities of other training aids in terms of the ARTP.

The assessment of the researched data established that the ARTP most frequently was evaluated in terms of training aids based on modern information technologies. **Educational software and films** were the most common objects of comparisons (see Table 8). At least 5 groups from 6 referred to different qualities of the ARTP.

A comparison of the ARTP and computer shows that the majority of the surveyed participants emphasize the interaction of the created training tool with a real object which is very important teaching students with disabilities and disorders (…*can be touched. It's very important to children with special needs*). Another idea promoted within the interview is that the ARTP rather than educational software make the students work more intensively (*demonstration of educational material through the Power Point program makes a child only a viewer whereas in our case, a child is actively involved into the process of learning*). A few statements that the ARTP and 3D environment rather than computer

increase the picturesqueness of the above discussed educational tool were explicated (*computer has no 3D media; 3D media gets a clearer view in comparison to that produced by computer; platforms offer more clarity; unlike computers, 3D medium is a quality of the platform*).

Single propositions about the evaluation of ARTP in terms of educational films were expressed. A small amount of similar statements show that exactly these tools were not used as often as educational software. It is likely that certain special provisions can help with explaining constant teachers-practitioners' efforts to use computer equipment though the teachers themselves state that a part of schools are not fully provided such possibilities (Samuolienė, žiūr. 2007).

Meanwhile, a great majority of schools have video equipment, TV sets and favourable possibilities of obtaining educational films for students of different age (Mokomųjų filmų...katalogas, 2007). However, in the age of information technologies, the dissemination of good experience of applying educational DVD films is a rare phenomenon. As mentioned above, the comparison of the ARTP and educational films refers to single respondents' propositions. Nevertheless, they clearly reveal the most important tendencies of the teachers' opinions from this point of view: *films distort human perception because children can watch things not existing in reality*.

Table 8. The evaluation of the teaching/learning platform in terms of other training aids.

Categories	Subcategories	Summarized propositions
Qualities of the ARTP in terms of training aids based on modern information technologies	*In terms of educational software*	The ARTP most frequently was compared with educational software. The following qualities were distinguished: 3D space creating conditions for picturesqueness and clearer perception of information; game elements included in the process of learning and not widening a gap from reality; possibility of making students interested involving them into intense learning activity; direct interaction with a real object; possibility of learning fully independently; possibility of developing students' ability to think; ARTP is a more modern tool of teaching.
	In terms of educational films	A comparison with educational films highlights strong links with the real environment which is one of the qualities of the ARTP.

A comparison of the ARTP and other training aids (written, static visual, verbal etc.) disclosed the following qualities of the ARTP: due to the 3D environment, the ARTP is a more engaging, offering much more picturesqueness and stimulating students' thinking tool of learning (see Table 9). Discussing the qualities in terms of written training aids, one of the focus groups noticed that the course books used in comprehensive schools were not adapted to students with special educational needs as *material was incoherently presented* ignoring the principle of picturesqueness. Apart from the ARTP, educational material is introduced following the attitude synthesis – analysis. Planning educational material in a similar way is aimed at students' ability to perceive an object or phenomenon as the wholeness; at a later stage, while performing the tasks the learner should examine all components of the wholeness. Moreover, the possibility of taking after the above introduced scheme - synthesis – analysis – synthesis - always exist i.e. having completed tasks and thus having examined separate components of the wholeness, the possibility of joining the wholeness of the subject/phenomenon is offered. As students with special educational needs find relevant hearing the same information and repeating the same tasks several times, the latter scheme of introducing educational material can be extended as many times as required. The described quality of the ARTP supports the respondents' propositions that *learning using the ARTP is much more interesting than reading a course book which has no need*.

Quite a few opinions were passed comparing the ARTP with **static visual** (moulages, models) and **verbal** (teacher's interpretation) training aids still widely used in schools. In this case, the respondents referred to such qualities of the ARTP as dynamism (*one thing is showing the bloodstream system in a poster, the other – a child uses this technology to observe heart motion and blood circulation through a small and big circles and to hear heart murmurs*), picturesqueness (*a poster is a*

flat picture that cannot be given a turn or universally examined) and the possibility of transferring information to the real environment (*when examining a moulage there is no transformation to reality; in this case, it should be a good idea*).

The teachers' discussions on the ARTP and interpretation which is still widely used in comprehensive school underlined a poor quality of picturesqueness and low efficiency of the latter tool (see Table 9).

Table 9. The evaluation of the teaching/learning platform in terms of other training aids.

Categories	Subcategories	Summarized propositions
Qualities of the ARTP in terms of other training aids	In terms of written training aids	It is stressed that the ARTP rather than the course book is a more engaging learning tool. Moreover, the course books are not adapted to students with special educational needs as learning material is incoherently presented ignoring a system clearly understandable to the students. Thus, learning from a text book does not help with achieving expected results that could be achieved using the ARTP.
	In terms of static visual training aids	A comparison of the ARTP and static visual training aids shows that the 3D environment providing maximum picturesqueness to training material is accepted as a great quality of the ARTP in terms of the above mentioned tools. In addition, unlike the ARTP, work with static visual aids does not offer a possibility of transferring knowledge and abilities to reality and the learner is a passive observer (the ARTP makes a student an active participant of the learning process). The ARTP is a dynamic tool transferring a picture in motion.
	In terms of verbal training aids	Picturesqueness is a quality of the ARTP in terms of verbal training aids.

It must be mentioned that single qualities of other training aids in terms of the platform were noticed. The presented data illustrates that the propositions demonstrating the qualities of other training aids are not defined and specified (see Table 10).

Table 10. The evaluation of the teaching/learning platform in terms of other training aids.

Categories	Subcategories	Summarized propositions
Qualities of other training aids based on modern information technologies in terms of the ARTP	Qualities of educational software	Computer is a closer and more realistic perspective for the future.
Qualities of other training aids in terms of the ARTP	Qualities of written aids	Written training aids are primary learning sources necessary for further steps in studying.

An evaluation of the possibilities of implementing the ARTP in schools disclosed positive and negative perspectives (see Table 11). The propositions of both categories are poorly defined in order to specify conditions ensuring the real perspectives of implementing the ARTP in schools. Therefore, the major problem looking at the perspective of applying the ARTP in schools which is the size of the construction can be clearly noticed. As a result of this reason, even the positive perspectives of implementing the ARTP are seen in view of a certain reservation: *the size of similar platforms, probably, will decrease and they will become more compact*.

Table 11. The evaluation of the teaching/learning platform. Perspectives on implementation in schools.

Categories	Subcategories	Summarized propositions
Perspectives on implementing the ARTP in schools	*Positive*	The opinions are passed that hereafter, the size of the ARTP will decrease, the operation system will be more advanced and a number of presently faced questions will be solved. Thus, it's worth thinking of implementing the platforms in schools.
	Negative	Platform implementation encounters certain problems. One of those is a danger that it'll be complicated to realize the ideas promoted by scientists and teachers. Another one is the size of the construction which will make impact on the perspectives of implementing the ARTP in schools.

The discussions on a practical use of the ARTP disclosed that the experts assisting with teaching/learning issues see the real possibilities of applying a new training tool in schools. The respondents addressed these possibilities to the method of using the ARTP, benevolent policy of the Government and appropriate conditions necessary for optimal use of this tool (Tables 12 and 13). The debates varied in positions on how to employ the ARTP to make its impact effective. The majority of the surveyed respondents fully agreed on the issue that in order to organize educational activity for students with special educational needs, one set of the ARTP would be enough: *there are from 8 to 10 students with special needs in the class. Thus, looking at the present situation on the interactive board, 1 platform for a school should be enough*. A possibility that all students in the classroom can be offered a chance to work at the ARTP is fixed under circumstances that a school will own more than 1 platform. However, further discussions on this issue reveal a number of aspects which currently cannot be seriously considered:

- What is the required number of the ARTP necessary for effective work in the classroom?
- What are the methods of involving students with special educational needs into similar activities?
- What are the ways of solving the problems of time management?

Similar questions show the relevance of the discussions on the above introduced topic in the future as now, only general guidelines on the possibilities of using the ARTP are set out. The same situation occurred in one of the focus groups where the idea of establishing a training centre at regional or national level had been promoted. A part of the respondents suppose that it is likely that a larger number of the ARTP will not serve the purpose in a bigger school. A special centre should be the place where gifted and motivated students and their teachers could come. The ARTP used for the purpose of training exactly these students should be perspective and useful investment. Nevertheless, the above presented idea was contradicted by the other part of the members of the same focus group: such centre is not a good idea as in that case, it will be an excursion, attraction but not learning: it will be difficult to efficiently use the platforms placed in the city centre (see Table 12 annexes).

Opinions that inappropriate policy of the Government might prevent from implementing and applying the ARTP in schools were stated. To discuss this issue, two aspects were found relevant: proper sponsorship for schools and accepting a good experience of foreign countries (see Table 12).

Table 12. Evaluating the possibilities of using the teaching/learning platform in schools.

Categories	Subcategories	Summarized propositions
A method of using the ARTP	*One platform for a school*	In order the ARTP should be effectively used for the purposes of educating students with special needs, a school should own at least one platform (as only the minority of students suffer from different disorders in schools, one platform should be enough to make activity rather effective). A few suggestions on how activity based on the ARTP could be arranged were offered: the ARTP should be placed in the school library (considering a universally accepted statement that a library is the centre of information at school); the ARTP should be arranged in the room for a special pedagogue (arranging individual classes for students with special needs should prevent them from attending lessons under the school timetable); to follow safety requirements, it could be set up in a separate room. One platform could be placed in a common classroom. If work at the ARTP was organized so that the pictures created on the platform could be seen by all learners in the classroom, it would be an optimal solution. One platform could be effectively used in school for children requiring special education (8 students in the classroom; an assistant helps the teacher; 5 or 6 lessons a day allowing every student to learn at the ARTP).
	A few platforms for a school	One platform is not enough for work in the classroom as due to lack of time not everyone will be offered a possibility of using it. An adequate number of similar platforms are required so that a half of the class could simultaneously work. It would be ideally perfect if all students in the classroom could be involved in the process of learning and those with special educational needs could work together with a special pedagogue. Then, the students will be provided opportunities to regularly evaluate every topic. It will be useless in case of an episodic event.
	A centre in a city/ country	A special centre in the city or country should be established. The classes should be coordinated by an expert.
Benevolent policy of the Government	*Investment in schools*	The education policy of a modern state should focus on investment into education of students with special educational needs. No matter how much the ARTP will cost because it's worth receiving sponsorship for schools and investing in modern training tools. It's likely that the ARTP will help with integrating people suffering from different disorders into life. The more independent they will feel the fewer problems will encounter people round.
	Accepting a good experience of foreign countries	When educating children and young adults with different disorders, it was offered to use a good experience of Belgian and Swedish colleagues. To teach students with special needs, for a number of years, the above mentioned countries have employed information technologies. Even children with severe cerebral palsy are taught applying information technologies.

The teachers thoroughly familiar with the current situation at school defined conditions necessary for the effective use of the ARTP teaching students with special educational needs (see Table 13). Close attention was paid to discussions on the specificities of organizing the teaching/learning process (*the ARTP should be applied yet from the first year of studies at primary school so that the children could be introduced the platform in advance*). It was noticed that the ARTP could be optimally used for individual student work (*individual work should be a better option for a child with special needs*). Particular topics included in the content of teaching are thought ahead mastering of which should be achieved through the purposeful use of the ARTP (*easy to learn geometric figures and bodies; the platform is fully equipped for studying trigonometry*). A relevant question raised by the teachers-practitioners is a regular supply of required aids which should be standardized. A few focus groups mentioned that the possibilities of implementing and applying the ARTP could be properly explained conducting empiric research with students (*should be useful to watch the children with special needs working at the platform; the carried out research should be the best option*).

Table 13. Evaluating the possibilities of using the teaching/learning platform in schools.

Categories	Subcategories	Summarized propositions
Conditions required for the optimal use of the ARTP	*Use for individual students' work*	Using the ARTP for the purposes of teaching students with special educational needs individually is the most optimal decision. Such activity should help the students with concentration.
	Supply with required aids	The teachers using the ARTP should be supplied with standardized training aids (real objects, its models and lesson scenarios).
	Adaptation to the content of teaching	The platform should be suitable for studying trigonometry, geometric figures and bodies and for extracurricular activities.
	Specificities of organizing the teaching/learning process	It was stressed that the level of computer literacy was not required to be very high when learning with the ARTP. It is likely that the majority of students will understand the essence of work. It is important that educational material should be properly introduced. Quite a few suggestions on the questions about organizing the teaching/learning process were made: in order the picture of the ARTP construction shouldn't put the process of teaching/learning in the shade, the platforms must be introduced as early as possible at primary school; the ARTP should be reasonably used; this technology should remain an additional tool for teaching; the ARTP can be purposefully used for solidifying and specifying knowledge; the ARTP could be used only for group work in the classroom and take a half of the lesson. The use of the ARTP for the purposes of teaching students with special needs is stronger emphasized. The learners should see and hear the same information. The pace of the program should be considered – some tasks require more time to be accomplished. The tasks given to students with special needs should be simplified and adapted to the groups of learners with certain disorders.
	The need for scientific research	Before making a decision on what groups of students mostly require the ARTP, it should be useful to watch children with special educational needs working at the platform. The majority of them are able to use a computer mouse whereas this platform raises a number of questions. Therefore exhaustive research is required.

The discussions show that the use of the ARTP will make impact on such aspects of teacher's activity as competence and role in the classroom, teaching load etc. (see Table 14). The impact of the ARTP on teachers' competence disclosed the differences in respondents' opinions: a part of those thought that before using the ARTP the teachers would have to increase their competencies in order to individually succeed in preparing the required educational material corresponding to the learners' needs and to place it into the system (*a teacher should be offered a possibility of preparing educational material placing it into the system*). The second group of the surveyed participants took up a position that teachers should prepare neither lesson scenarios nor teaching material. All this work should be produced by trained competent experts. While organizing educational activity on the basis of the first model, it should be worth thinking about favourable conditions that ensure mastering and creation of operating the ARTP i.e. preparation and implementation of short lessons on operating the platform and providing special training.

In order to stop the increase of teaching load and to completely fulfil the needs of all students, a teacher's assistant should be employed (*effective use was possible if an assistant would help a student*). One of the groups established that in particular cases, the ARTP could replace a teacher: *sometimes work at the platform could replace introductory teachers' interpretation*.

Table 14. The evaluation of the teaching/learning platform. Impact on teacher's activity.

Categories	Subcategories	Summarized propositions
Impact on teacher's competence	*Necessity of increasing the level of competencies*	If schools use the ARTP, a necessity of increasing teachers' competencies will appear: computer literacy at established level will be required; it should be useful to know how to produce teaching material and to place it into the computers of the platform to the teachers themselves; it should be perfect if the teachers were able to individually prepare lesson scenarios.
	Need for receiving help from competent experts	In order to optimally use the ARTP, assistants should help the teachers to construct the lesson scenarios considering the suggested needs. In this particular case, the teachers themselves shouldn't be involved in similar activities.
Impact on teaching load	*Teacher's assistant is required*	The platform could be effectively used in case a teacher and an assistant worked in the classroom. The assistant should help the learner in using the ARTP. This is very relevant to the students with special educational needs.
Impact on teacher's role	*Changes in teacher's role*	Work at the platform sometimes could replace introductory teacher's interpretation i.e. the ARTP could be effectively used for introducing new teaching material.

Probably the most significant part of the discussion with the experts providing special assistance in teaching is debating the possibilities of applying the ARTP for students having certain disabilities and disorders (Tables 15, 16 and 17). The respondents' propositions under this topic fall in a few categories:

- students with disabilities finding the ARTP for learning purposes effective;
- students with disorders finding the ARTP for learning purposes effective;
- students with disabilities and disorders finding the ARTP for learning purposes purposeless;

The propositions attributed to the category 'Will not manage…' are divided into several groups (subcategories): motional disorders, mental disorders, aural and sight disorders, common (no name) slight and moderate disorders. The data assessment points to the respondents' opinion that children having at least one of the above mentioned disabilities/disorders should find learning at the ARTP very purposeful (see Table 15).

Table 15. The evaluation of the teaching/learning platform applied for students with different needs.

Categories	Subcategories	Summarized propositions
Students with disabilities finding the ARTP for learning purposes effective	*Motional disorders*	Intellect is the main criterion of using the ARTP. If intellect is rational, the ARTP could be optimally used educating students with motional disorders under condition that in the course of time, the platform will be advanced and adapted for such students. If a child has coordination disorders or cerebral palsy but is able to use a hand, s/he will manage to work at the platform: in this case, operation functions should differ and the cursor should be placed using a hand or a special device fixed to it rather than 'the paddle' etc. The students with severe cerebral palsy could use lips or look to operate the system.

Categories	Subcategories	Summarized propositions
Students with disabilities finding the ARTP for learning purposes effective	*Mental disorders*	The ARTP should be very useful for students having slight mental disorders or slightly limited mental abilities. The curricula need to be adapted to the needs of students having the above introduced disabilities i.e. simplified, facilitated, even some extras (for example, headphones) can be ignored. Students with mental disorders and limited mental abilities can obtain more information by touching objects that is allowed while working at the ARTP. Moreover, students with mental disorders find engaging to repeat the same action several times. Using the ARTP, students with similar disabilities should be offered optimal possibilities of repeating tasks and listening to the same information several times etc. The ARTP should be suitable for professional training of children and young learners with mental disorders, for example they can be taught to build, project, produce windows etc.
	Aural and sight disorders	The ARTP is an exiting possibility of compensating children's aural and sight disorders. If a child has problems with hearing, the ARTP helps with improving the ability to hear and sight is involved in the process of learning. Children with aural disorders and using ear implants have a narrow verbal knowledge. They feel shortage of notional perception. The use of the ARTP should help children with the above discussed disorders to see and to hear, and thus should better perceive information. The situation on the weak-eyed can be twofold – one can find the platform useful, the other one can encounter difficulties. Nevertheless, a larger amount of audio information could help with solving the problem. The ability of touching is most important to a weak-eyed child.
	Common (no name) slight and moderate disorders	Should be appropriate for everyone having different slight and typical disorders; the tasks should be facilitated and adapted to the specified needs. Some students should need a smaller amount of information provided, some of those would feel happier with a reduced number of tasks.

Here is a list of the disorders of students finding the ARTP for learning purposes effective:

- speech and communication disorders;
- specific cognitive disorders;
- disorders caused by lack of motivation for learning;
- emotional and behavioural disorders;
- special educational needs;
- integrated needs;
- exceptional abilities (see Table 16).

Table 16. The evaluation of the teaching/learning platform applied for students with different needs.

Categories	Subcategories	Summarized propositions
	Speech and communication disorders	The ARTP should be suitable for students having speech disorders. The use of the ARTP should provide a child with the possibilities of hearing information many times. In addition, a program allowing to students with speech disorders explain work of voice chords, show the right position of the tongue uttering different sounds should be very useful. The real object should be a model of the organs of speech.

Categories	Subcategories	Summarized propositions
Students with disorders finding the ARTP for learning purposes effective	*Specific cognitive disorders*	The ARTP should be an appropriate tool for training students having specific perception, cognition and mental disorders (for example, dimensional perception) as the platform offers the possibilities of combining visual thinking and motorics which helps with perception. Moreover, children with special education needs encounter difficulties with abstract thinking and creating visuals of concepts. Taking into consideration picturesqueness and 3D medium, the ARTP should facilitate the understanding of abstract things. A specific disorder of perception indicating that relation between visual and audible understanding was distinguished. The platform could help with making corrections to the perception processes by adjusting connection between picture and sound and applying it to the needs of individual students.
	Disorders caused by lack of motivation for learning	The ARTP should be appropriate for students lacking information. This training tool should engage students, attract their attention and increase a wish for learning.
	Emotional and behavioural disorders	The ARTP should be suitable for those suffering from concentration, having emotional, behavioural and self-control disorders. Such students are only able to concentrate when they are interested in certain activity, training tools and information. It is likely that the platform will intrigue the above described students who can focus their attention and willingly work if find the things interesting. The ARTP could be optimally used for training hyperactive students as the tasks provided by the platform are short, specific and with no long introduction. Additionally, the ARTP should be useful for learners with communication problems as they unwillingly establish contacts with a teacher.
	Special educational needs	Such particular tool should be necessary for students with special educational needs, the learners who study in comprehensive schools under modified and adapted educational curricula. The ARTP should help with compensating drawbacks felt by the mentioned students, should create possibilities of filling the gaps in learning and broadening personal knowledge. It's a good idea that information should be acquired simultaneously using at least a few senses. The more senses are used in the learning process the more information will be mastered by students with special educational needs.
	Integrated needs	The ARTP should be effective for students having complex disabilities.
	Exceptional abilities	The ARTP is a very efficient tool for training bright students. This platform is a good individual possibility of getting to know new learning material by the students themselves, proceeding forward and broadening personal knowledge. Moreover, the ARTP should be helpful in developing bright students' creativity and changing types of activities. Bright students should deal with more complex tasks.

Some respondents' groups stated that a part of students with motional, aural, sight and complex disorders should find the ARTP for learning purposes purposeless (see Table 17). A detailed assessment of researched data shows that the statements falling in this category contradict the ones described in Tables 15 and 16. The above mentioned situation prevents from making conclusions until more thorough research is not conducted.

Table 17. The evaluation of the teaching/learning platform applied for students with different needs.

Categories	Subcategories	Summarized propositions
Students with disabilities and disorders finding the ARTP for learning purposes purposeless	*Motional disorders*	The ARTP shouldn't be suitable for students with motional disorders as they need to touch objects as many times as possible. While working at this platform the students will fail to perform similar actions. Moreover, their movements are not smooth and thus children can find difficult to hold the paddle or controller and to place the cursor. It is possible that fixing the paddle to a hand should help students with slight disabilities.
	Aural and sight disorders	The ARTP will not be applied to students with aural and sight disorders. If a learner has problems with seeing, the platform will be hardly adapted.
	Complex disorders	The platform can become purposeless to be used by those having complex disorders as work at the platform requires performing a number of simultaneous actions – seeing, hearing, reading and placing the cursor.

The data assessment indicates that experts assisting with special educational help see the real possibilities of implementing and using the ARTP in comprehensive school. Negative evaluations make a smaller part of the respondents' propositions.

Conclusions

The conclusion of the survey results shows that:

- the teaching/learning platform based on augmented reality technology is a helpful, interesting and innovative tool; however, in order to better ensure training of students with special educational needs, operation (operation tools) and work place comfortability should be advanced, the construction should be reduced and the operation of the learning platform should be entirely mastered (creating and introducing special short lessons);
- the ARTP owns a number of properties which possibly will make a positive impact on the student, teaching/learning environment and process. Therefore, the quality of the learning/teaching environment will improve and facilitate adaptation of students with special educational needs in the social environment where favourable conditions for ensuring successful functioning of learners will be created. The following characteristics of the teaching/learning platform have been distinguished:
- opens up strong possibilities of individual teaching/learning, communication and collaboration, independent learning, developing students' creativity, solidifying knowledge, receiving feedback information, interacting with a real object, obtaining simultaneous information using several senses, compensating weaknesses caused by certain health disorders and disabilities, getting concentrated i.e. brief and clear information;
- encourages students' motivation for learning, helps with expressing positive emotions within the learning process and increases students' interest in teaching/learning;
- facilitates the teaching/learning process;
- discloses high picturesqueness of educational material.
- The ARTP has quite a few qualities in terms of traditional (written, static visual and verbal) training aids and those based on modern information technologies. The following qualities of the ARTP in terms of personal **computers** and **educational software** can be distinguished:
  - unlike computer, the ARTP offers a student possibilities of interacting with a real object;

– it is likely that the ARTP rather than educational software will make students' work more intensive;
– information placed in the 3D environment is more picturesqueness than that seen on a computer screen.

The qualities of the ARTP in terms of educational films:

_ information transmitted through the ARTP is more realistic than that used in the lately created educational films.

The qualities of the ARTP in terms of **written, visual static and verbal** training aids:

– a comparison of the ARTP and graphic training aids (course books, schemes, drawing and posters) indicates that the latter ones are boring and not stimulating students' interest;
– an advantage of the ARTP over visual static training aids (models, moulages) is expressed through clarity and dynamism;
– verbal training aids are less picturesque than the ARTP.

- a great majority of the ARTP **drawbacks** are connected with **operation system and ergonomic parameters** (complicated, not adapted to students with special educational needs); unsuitable real object (horizontal flat of the digestive tract model is inappropriate); lack of comfortability of the work place (not enough space inside the construction, seating and standing are troublesome); the size of construction; material expenditures.
- the real possibilities of implementing and using the ARTP in schools exist. It is likely that the ARTP will be effectively used teaching students with special educational needs during individual and group work sessions as well as will be an efficient training tool within extracurricular activities.
- the teaching/learning platform can be successfully applied teaching students with different needs including:
  – students with slight mental disorders and slightly limited mental abilities;
  – students with specific cognition disabilities;
  – students having speech and communication disorders;
  – students with emotional and behavioural disorders;
  – students having disorders caused by lack of motivation for learning;
  – students with special educational needs;
  – students with extraordinary abilities.
- The efficiency of using the ARTP for the purposes of teaching students with motional, aural, sight and complex disorders is not unambiguous.

References

Adams, M. (2005). *The 10 Most Important Emerging Technologies for Humanity.* On line support@truthpublishing.com. [20-10-2007].

Ališauskas, A. (2002). *Vaikų raidos ypatingumų ir specialiųjų ugdymo(si) poreikių įvertinimo teoriniai metodologiniai aspektai.* Šiauliai.

Balčytienė, A. (1997). Kompiuterizuotas mokymas: kolektyvinio problemų sprendimo ir humanistinių idealų ugdymo prielaidos. Kn.: *Humanizmas, demokratija ir pilietiškumas mokykloje.* (IV tarptautinė mokslinė konferencija). Vilnius.

Domeikienė, K. (2005). I-II klasių mokinių, turinčių kalbos sutrikimų, verbalinio kūrybiškumo pokyčiai. *Pedagogika*, T. 80, p. 146-151.

Education for All. On line http://portal.unesco.org/education/en/ev.php-URL_ID=50558&URL_DO=DO_TOPIC&URL_SECTION=201.html [22-11-2007].

Evaluating Information and Communications Technology: Perspectives for a Balanced Approach, 2001. On line http://www.si.umich.edu/pne/kellogg/016.html [22-11-2007].

Galkienė A. (2003). *Pedagoginė sąveika integruoto ugdymo sąlygomis*. Šiauliai, 2003.

Jovaiša, L. (2001). *Edukologijos pradmenys*. Šiauliai.

Lamanauskas, V., Vilkonis, R. (2007). Information Communication Technologies in Natural Science Education: Situational Analysis and prospects in Baltic Countries. *Journal of Baltic Science Education*, Vol.6, No.2, p. 35-49.

Malonaitienė, V. (2004). Didaktinių žaidimų naudojimas V-VII klasių moksleivių gebėjimams ugdyti istorijos pamokose. *Pedagogika*, T. 73, p. 112-117.

Martišauskienė, E. (2005). Paauglių dvasinių vertybių internalizacijos ypatumai integruoto ugdymo mokykloje. *Pedagogika*, T. 80, p. 126-131.

Mokomųjų filmų, žaidimų, kompiuterinių mokymosi priemonių prdinei mokyklai katalogas 2007-2008 m. On line http://centras.puslapiai.lt/biblioteka/Mokomieji%20filmai%20zaidimai%20prad%20mokyklai%202007-2008.pdf [26-11-2007].

Raudeliūnaitė, R. (2005). Regėjimo neįgalumą turinčių paauglių socialinių įgūdžių lygmens ypatumai. *Pedagogika*, T. 80, p. 152-157.

Samuolienė, A. (2007). Apie vertybes ne tik žodžiu. On-line http://www.ipc.lt/liet/?pg=224&lang=1 [22-11-2007]

SITES – m2. Tarptautinės studijos „Informacijos technologija mokykloje“ antroji dalis. On line http://www.sites-m2.ipc.lt/? [22-11-2007].

Slabin, U. (2002). Promoting chemistry and community via environmental educational website. Kn.: *Gamtamokslinis ugdymas bendrojo lavinimo mokykloje*. Šiauliai.

Strauss, A., Corbin, J. (1998). *Basics of Qualitative Researh: Techniques and procedures for developing grounded theory.* London: Sage.

Un Millenium Development Goals. On line http://www.un.org/millenniumgoals/ [22-11-2007].

United Nations Literacy Decade. On line http://portal.unesco.org/education/en/ev.php-URL_ID=5000&URL_DO=DO_TOPIC&URL_SECTION=201.html [22-11-2007].

Vilkonienė, M., Lamanauskas, V., Vilkonis, R. (2007). Pedagogical Evalustion of the Teaching/Learning Platform Based on Augmented Reality Technology: the Opinion of Science Teachers. In.: *Information & Communication Technology in Natural Science Education – 2007*(International Scientific Conference). Šiauliai.

Židžiūnaitė, V. (2001). *Slaugos mokslinių tyrimų metodologijos pagrindai*. Vilnius.

Adviced by Laima Railienė, Siauliai University, Lithuania

Margarita Vilkonienė	Ph.D. student, researcher at the Siauliai University, Lithuania. P.Vishinskio Street 25-119, LT-76351 Siauliai, Lithuania. Phone: + 370 650 14399. E-mail: vilkarita@yahoo.com Website: http://www.gutc.su.lt
Vincentas Lamanauskas	Professor of Education at the University of Šiauliai, a doctor of social sciences (education), the chairman of a public scientific methodic centre "Scientia Educologica" P. Vishinskio Street 25-119, LT-76351 Siauliai, Lithuania. Phone: +370 687 95668 E-mail: v.lamanauskas@ef.su.lt Website: http://www.lamanauskas.projektas.lt
Rytis Vilkonis	Senior Researcher at the University of Siauliai, Faculty of Education, a doctor of social sciences (education). P. Vishinskio Street 25-119, LT-76351 Siauliai, Lithuania. Phone: +370 650 14299 E-mail: vilkonis@yahoo.com Website: http://www.vilkonis.projektas.lt/