SOCIAL AND COGNITIVE CONSTRUCTIVISMS IN PRACTICE ON THE BASIS OF ETWINNING PROJECTS IN SCIENCE

Elżbieta Gajek

ABSTRACT
The role of social interactions and cognitive processes in learning is evident for teachers and educators. Nowadays there is a challenge to transfer the theory into practice, to build an environment in which learning science is integrated with the practical use of technical, linguistic and intercultural skills in cooperation with peers from other countries while communicating through ICT. eTwinning projects in science, geography and biology show that schoolchildren can successfully work together in international groups. Both theoretical ground, added value of such cooperation in science and hands-on examples based on eTwinning projects undertaken in Polish schools rewarded on national and international levels will be presented as well as the eTwinning action as part of LifeLong Learning European programme.

KEYWORDS
Social constructivism, cognitive constructivism, e-learning, eTwinning, international cooperation, Web-based learning

INTRODUCTION

The ground for transformations in education has been already established. Piagetian cognitive constructivism (Piaget, Inhelder 1966, Piaget 1983) and Vygotskian social constructivism (Vygotsky 1981) give framework for understanding how learners think and learn, what environments can support learning. However, the implementation of the constructivist ideas into teaching practice is still a challenge for educators.

On the one hand, the use of technology enhances learning of all subjects in many ways. ICT also changes educational culture. Interactions with computers empower learners. Thus the teacher and students' roles change. On the other hand, the potential of ICT cannot be fully exploited because of cultural barriers, that is the mental representation what education is and what is a supportive learning environment (Papert 1980). In the era of integration of scientific domains there is a need for rethinking and creating learning environments in which students may develop various skills and competences in an integrative, holistic and cooperative way. Such innovations in education cannot be introduced in top-down political processes, they need to reflect tendencies in social and educational cultures (Papert 1980, Uzunboylu 2006). Thus, bottom-up processes identified and supported may trigger a significant change in education. An example of such bottom-up process can be an eTwinning programme.

Although it may seem that international cooperation in projects with the theme in maths and natural sciences, such as physics, chemistry geography and biology is reserved for academic scientists in these fields, the participants of eTwinning projects in schools from kindergarten to upper secondary level give evidence that cooperative work with colleagues from other countries on maths and science in foreign languages is not only possible, but also mutually beneficial. In the projects students develop subject skills while using ICT, communicating in foreign languages, gaining experience in intercultural

cooperation. And what should not be underestimated they have fun sharing interests, passion with peers in other countries. Learning becomes meaningful and emotionally engaging, that leads to higher motivation. From the research perspective when a new learning environment is being created, for initial studies naturalistic qualitative methods and tools such as observations and teachers reports, are more adequate than quantitative analysis attempting to show benefits "in numbers" (Cohen at al. 2003)

eTWINNING PROGRAMME

eTwinning programme is a European initiative built to create an environment for cooperation of pre-primary, primary and secondary schools in. It started in 2004 (Gajek, 2005, 2006, 2007, Uzunboylu 2006, Gajek, Poszytek 2009). Its aim is to provide teachers with a friendly tool for using technology in school projects. The participants may communicate and share materials with the use of portal tools. As the project work requires neither any money received nor spent, bureaucracy related to budgetary issues is eliminated. Any school can participate as the portal is free of charge. All tools are accessible for registered users, that is teachers and learners. The use of digital tools is not limited to the tolls available on the portal. The participants may utilise any of popular internet tools, such as podcasts, Skype, You Tube, Flickr. At least two partners from schools in two different European countries out of 32 eligible can make a partnership to conduct a project. The project theme and the stages of work plan are negotiated between the partners.

Within the last 5 years the program has become very popular in Europe. Over 52 thousand of schools with over 64 thousand of teachers got involved in June 2009. Although 21 languages were used as means of communication in the projects in 2009, English was the main language of communication in projects (66%), followed by German (11, 5%) and Polish (7%) as Pietrzak (2009) states.

eTwinning programme is also a good example of e-learning at primary and secondary education – it is a good introduction into gradual change of teaching and learning towards more intensive use of digital tools in education. Web-based learning in which sometimes active use of ready-made materials available on the Internet is perceived as more important than communication and creation of knowledge becomes more divers and more suitable for various learners having various cultural background. Regarding the number of participants in this programme in Europe it is worth looking at this educational movement from the constructivist approaches.

TWO APPROACHES TO CONSTRUCTIVISM

Although the two abovementioned constructivist – Vygotskian and Piagetian – approaches differ to some extent and were often presented as opposed, with years methodologists started to perceive them as complementary. In this article they are used to provide the ground for explanations of the learning processes in international projects. One approach stresses the role of mental activity of a learner. The other emphasises social interactions that are indispensable for learning. Below there is a brief presentation of the approaches, even though they are well known among educators.

Jean Piaget (1966, 1983) stressed the idea that learner is an active creator of his or her knowledge. Learners construct what they know, they build and verify the theories to explain the world. Piaget differentiated the objective knowledge and the subjective knowing. He noticed that nobody can check whether the other person's experience and subjective perception of the world is the same or not in comparison with his or her own.

Lev Vygotski (1981) was interested in what learner can achieve by himself in the sphere of proximal development and what kind of help he or she needs to develop further. The help may come from the learning environment, either from other people or from scaffoldings embedded in the environment.

They both perceived the importance of individual mental activity and the social interactions. However each of them emphasised more the former or the latter. In international projects mental activity of the

participants is enhanced by emotional, linguistic and cultural stimuli in social contacts with partners from other cultures. In such contacts many of interaction models that function in one community are challenged and need to be renegotiated which gives ground for intercultural competence development. The learning environment is also enhanced by the active learning of teachers who participate in the project.

However, constructivist approaches are criticised because it is really difficult to sift such learning in standardized tests. If knowledge is subjective as Piaget claims and experience of two people is not even comparable, how to assess the effort of students, teachers, schools and educational systems, how to check if they are accountable. Furthermore, the environment in which students are likely to develop and build their knowledge is much more complicated from the organizational and managerial perspectives and the results are less testable. Individual and group cultures differ, which makes the assessment and accountability issues even more vague and troublesome.

The role of culture is emphasised by Seymour Papert (1980/1996: 200). Basing on Jean Piaget ideas he suggested that new social forms, e.g. interaction with computer or going further in development through computer have to be rooted in culture. He pointed that successful educational innovations should be sensitive to tendencies of movements in culture. The cultural trends should be used as vehicles of educational interventions and transformations. An example of the adaptation of such cultural trend to education is eTwinning programme.

CULTURAL GROUND FOR SCIENCE

Science and technology are not popular in many places in Europe. According to Eurobarometer 224 (2005) citizens of European countries present varied interest in new inventions and technologies and implementation of science in their everyday life and their usefulness in daily life. The charts below present the results of European comparative studies.

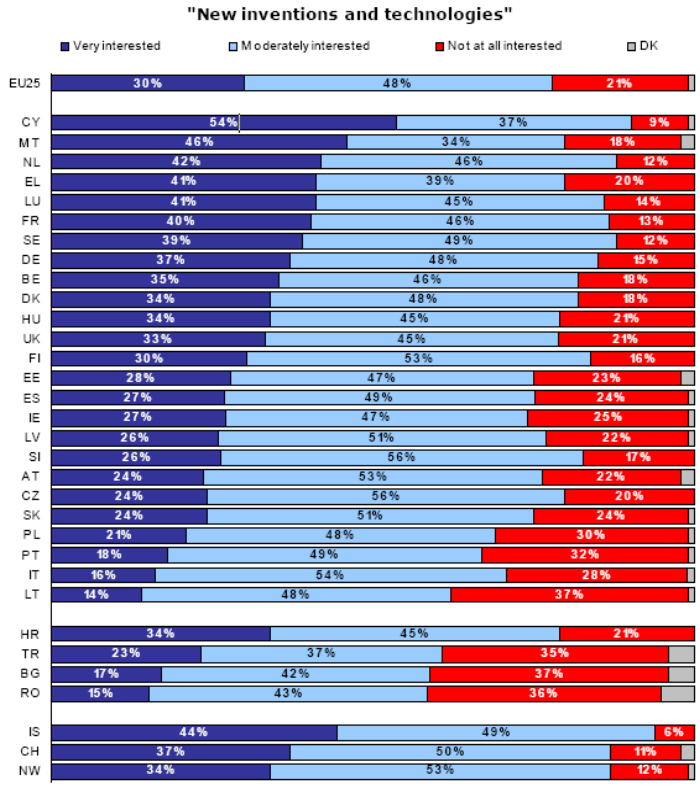

Figure 1. Interest in new inventions and technologies among the Europeans (Source Eurobarometer 224:7, http://ec.europa.eu/public_opinion/archives/ebs/ebs_224_report_en.pdf)

Collaborative project work give students a chance to observe how the interest in new inventions and technology or lack of it may influence life of their families and communities. However the interest is parallel to the perception of usefulness of new technologies in daily life only to some extent as the chart below shows. In international cooperation students and teachers may experience other approaches to science and technology than those taken for granted in their own culture.

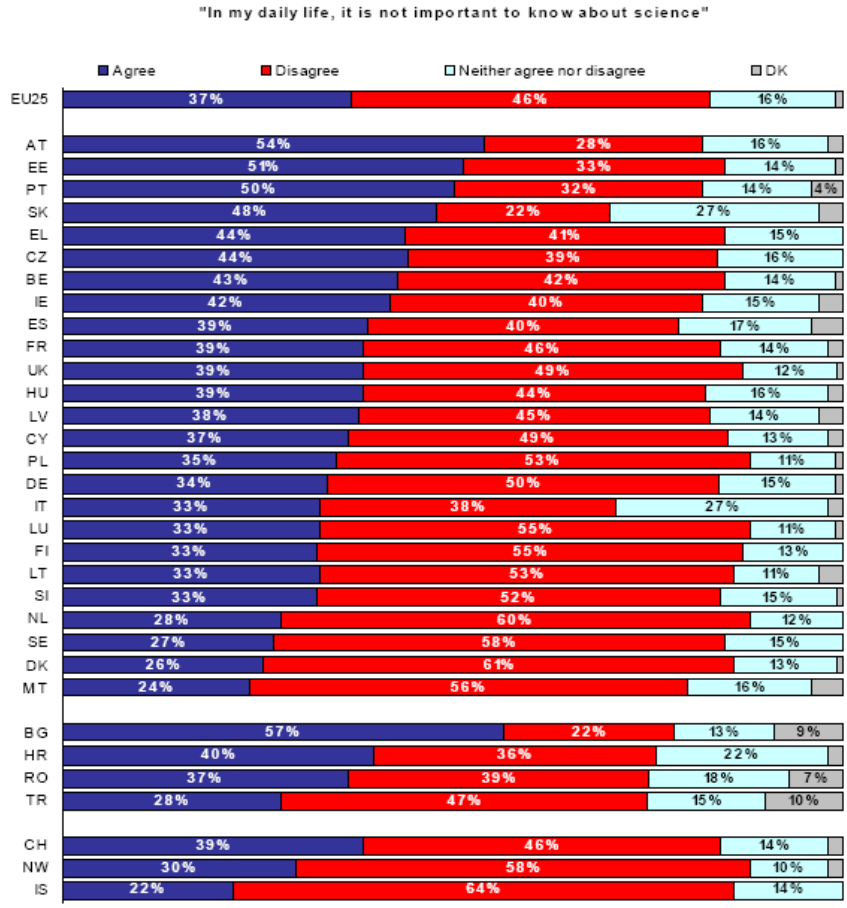

Figure 2. Perception of science knowledge importance in daily life (Source: Eurobarometer 224: 68, http://ec.europa.eu/public_opinion/archives/ebs/ebs_224_report_en.pdf)

The European, or even a global, challenge is to enable all learners, boys and girls, to construct their subjective knowledge in social contacts using the full potential of their cognitive capacity and cultural interests. That means that the solution is in the constructivist approaches to learning science, in integration of culture and science in a culturally and socially meaningful way. For a start eTwinning projects can serve as practical example how to do it.

EXAMPLES OF eTWINNING PROJECTS IN SCIENCE

Observations of activities in projects and student's response to them as well as teachers' reports give ground for the following findings. Firstly, the benefits of eTwinning projects are obvious in language learning, as the learners communicate with partners, negotiate meaning and clarify their messages in direct contact via technology. They *learn by doing*, so they also get to know better the target language culture or the culture of the partners as well as their own. Secondly, the benefits such as raising motivation to learning and interest in science are also perceived in computer sciences, as the project creates natural environment for the practical use of ICT. In such projects both the language and the technology are used as instruments for learning. However, some educators find it difficult to discover the potential of international web-based projects in teaching and learning natural science. That is why,

such projects with the theme in natural sciences are less popular than oriented on languages and ICT (Gajek, 2007). Nevertheless, there many examples how teaching and learning maths and natural science can be integrated with learning languages, technology and intercultural skills.

The teachers report, e.g. in their applications for eTwinning Quality Label, that the role of technology in the science projects is multidimensional. It enables visualization and simulation of mathematical phenomena, helps students to discover various theorems on their own. They also get confidence in using technology for education not only for pleasure. Technology which serves as a communication channel facilitates problem solving and sharing experience. The content of science education is universal independent from any cultural influence. However, it is beneficial for teachers to observe how educational traditions influences approaches to teaching science. For a teacher it does make a difference to experience various methods of teaching science not to be told how they look like.

Among the examples of outstanding projects in science there are some which were awarded eTwinning National and European Quality Labels and National or European awards in contests in Maths and Science in 2008 and 2009.

1, 2 Buckle my Shoe is an example how to introduce science in kindergarten. At their website everything the activities are presented for the followers: http://twinmath.wikispaces.com/

In the project *The Entertaining Physics Class* – the title speak for itself. It is an example how to make learning physics fun.

The world is more than catches the eye deals with chemistry. They write: "We aimed at showing that Chemistry is a very important subject, that it is everywhere and it can be very fascinating. We managed to do it. We prepared the lesson plan 'Chemistry in English' with some experiments which is very innovative in my school."

The project *Alternative energies* is described as follows: "Why do we have to search for sources of alternative energies The partner groups look for the information about exhausted sources of energy, they make presentations and share with them on eTwinning space, giving the answer to the question at the same time. Inexhaustible sources of energy. The partner groups look for alternative, ecological sources of energy, make their description, prepare Power Point presentations and put them on the Twinspace. Among all of them they choose three sources of energy, which will be the subject of research: solar, wind and water power".

We are so different, but the same sky touches our faces. The motto of this project is that "Physics joins people of different nations, cultures and religions".

In 2010 the European award is granted to *Magic but real experiments* in the science category. Physics is presented in this project in as fascinating way as nature could be.

To sum up, catchy title, inspiring topic, great fun and astonishing results – these qualities are characteristic of all eTwinning projects including these in science. Such projects prove to be a way of raising motivation towards science via intercultural contacts in a multilingual environment.

INTEGRATION OF SKILLS AND COMPETENCES IN INTERNATIONAL PROJECTS

While working with foreign partners students develop various kinds of skills and competences. This constitutes the added value of such projects. All eight key competences recommended for LifeLong learning are interchangeably increased. Students communicate in their mother tongue with peers in their own schools. They also communicate the foreign language which is the main language of the project. What is more, they can use other languages, learn some vocabulary in the native language(s) of the

partners. Together with the language the acquire some knowledge of the partners' culture and practice intercultural understanding.

Participation in the projects may prevent mathematical and science illiteracy, which is a cultural phenomenon and which has been announced for decades. Project work may encourage learners to get interested in maths and science. "By participating in these projects pupils make these conclusions on their own and, consequently, these become an element of their own outlook that they have reached individually and not a 'revealed truth' proclaimed *ex cathedra*" (Orłowski, 2009). The project work can be perceived as an example of constructivist approaches implemented at school levels. Students create their knowledge individually, however, in cooperation with foreign partners and colleagues in their own classes. Learning science becomes engaging and fun. What is more, teachers also develop their methodology and professional skills in cooperation with counterparts from the partner schools. However, creation of knowledge individually and socially, exclusive by nature, is in conflict with the ideas of unification and egalitarian trends in education. Thus, it is unlikely to be fully implemented. eTwinning example shows how to match the two – learning can be both exclusive and egalitarian.

CONCLUSIONS

eTwinning experience, exemplified in qualitative research through teachers' reports, shows that learning in cooperation with partners from other countries is attractive and beneficial. Participation in a project helps to integrate soft skills such as cooperation, communication in foreign languages, problem solving and self-management in intercultural contexts with subject knowledge in science and technology.

The theoretical ground based on constructivism is sufficient for enabling each learner to build knowledge in social contacts. The two approaches attempt to explain how individual development and social interactions interrelate in science projects in international educational contexts.

International communities in which people cooperate to build knowledge and skills in science are no longer restricted to academic staff. Children and teenage students can do the same on their own. What is more, the process of individual discovering of the world by the young is as fascinating as it was for pioneers of physics.

REFERENCES

Cohen, L., Manion, L.,Morrison, K. (2000) Research Methods in Education. London & New York: RoutledgeFalmer.

Donaldson, M., (1978). Children's Minds, Fontana/Collins, Glasgow. Polish edition, Translated by: A. Hunca-Bednarska, E. M. Hunca. Myślenie dzieci. 1986.

Gajek, E., (2005). eTwinning Europejska współpraca szkół Polska 2005/European Partnerships of Schools Poland 2005. Fundacja Rozwoju Systemu Edukacji, Warsaw, Poland. Also available online http://etwinning.pl/files/broszura_eTwinning2005.pdf.

Gajek, E., (2006). eTwinning Europejska współpraca szkół Polska 2007/European Partnerships of Schools Poland 2006. Fundacja Rozwoju Systemu Edukacji, Warsaw, Poland. Also available online http://etwinning.pl/files/Broszura_eTwinning2006.pdf.

Gajek, E., (2007). eTwinning Europejska współpraca szkół Polska 2007/European Partnerships of Schools Poland 2007. Fundacja Rozwoju Systemu Edukacji, Warsaw, Poland. Also available online http://eTwinning.pl/files/broszura_eTwinning2007.pdf.

Gajek, E., (2007). eTwinning przykładem e-learningu w oświacie. [online] e-mentor nr 2 (19) http://www.ementor.edu.pl/artykul_v2.php?numer= 19&id =407.

Gajek, E., Poszytek, P. (eds.) (2009). eTwinning drogą do edukacji przyszłości. Fundacja Rozwoju Systemu Edukacji, Warsaw, Poland; Also available online http://www.etwinning.pl/files/e-bookPL.pdf; Also available online in English. eTwinning – A way to education of the future. http://www.etwinning.pl/files/e-bookENpoj.pdf.

Gilleran, A., (ed.) (2006). Learning with eTwinning 2006. http://www.etwinning.net/shared/data/etwinning/booklet/booklet_final_en.pdf.

Orłowski, A., (2009) The Role of eTwinning Projects in Mathematics and Science Education. Fundacja Rozwoju Systemu Edukacji, Warsaw, Poland.

Papert, S. (1980). Mindstorms: Children, computers and powerful ideas. New York: Basic Books Polish edition, Translated by: T. Tymosz, Burze mózgów; Dzieci i komputery. Wydawnictwo Naukowe PWN. Warsaw, 1986

Piaget, J., (1983). Piaget's Theory. W: Mussen, P. Handbook of Child's Psychology. Wiley, New York, 703-732.

Piaget, J., Inhelder, B., (1966). The psychology of the child. Translated by: H. Weaver. Basic Books, New York, 1969.

Pietrzak, A., (2009) Significance and Development of the eTwinning Programme in Poland as Compared to other European Countries, Fundacja Rozwoju Systemu Edukacji, Warsaw, Poland.

Uzunboylu, H. (2006), A Review of Two Mainline E-Learning Projects in the European Union, Educational Technology Research and Development. 54(2), 201-219.

Vygotsky, L., (1981). The genesis of higher mental functions. W: Wertsch, J. V. (red.) The concept of activity in Soviet psychology: M.E. Sharpe, Armonk, N.Y,144-188.

Elżbieta Gajek
1st Affiliation
Computer Assisted Education and Information Technology Centre
02-026 Warsaw, Raszyńska 8/10
Email: egajek@oeiizk.waw.pl

2nd Affiliation
Institute of Applied Linguistics University of Warsaw
ul. Browarna 8/10, 00-311 Warszawa, Poland