World Journal on Educational Technology: Current Issues

Vol 8, Issue 3, (2016) 180-189

www.wj-et.eu

Design based research: The way of developing and implementing

Tina Štemberger *, Pedagoška fakulteta Univerze na Primorskem, Cankarjeva 5 SI - 6000 Koper, Slovenija.
Majda Cencič, Pedagoška fakulteta Univerze na Primorskem, Cankarjeva 5 SI - 6000 Koper, Slovenija.

Suggested Citation:
Štemberger, T., & Cencič, M. (2016). Design based research: the Way of developing and implementing. *World Journal on Educational Technology: Current Issues. 8*(3), 180-189.

Received May 11, 2016; revised July 12, 2016; accepted August 30, 2016
Selection and peer review under responsibility of Assoc. Prof. Dr. Fezile Ozdamli, Near East University.

Abstract

The appropriate implementation of innovation is a crucial factor in improving educational practice. In the implementation process, there is, however, often a lack of interaction between designers and practitioners that would enable the latter to become competent enough to implement theoretical knowledge into practice and to have an ongoing support from designers. Design-based research is based on close cooperation between researchers, practitioners and designers which consequently allows greater integration of research and practice in education. In the present paper, the beginnings, development, basic characteristics, advantages, disadvantages and the research process of design-based research are reviewed and an example of design-based research is presented.

Keywords: design-based research, educational research, educational innovation, mixed methods research, educational improvement.

*ADDRESS FOR CORRESPONDENCE: **Tina Štemberger,** Pedagoška fakulteta Univerze na Primorskem, Cankarjeva 5 SI - 6000 Koper, Slovenija. *E-mail address*: tina.stemberger@pef.upr.si

1. Introduction

Innovations are essential for any kind of progress, being on individual or societal level, hence they are also crucial when trying to improve various aspects of educational practice. Innovation is believed to be a complex and not uniquely defined phenomenon (Likar, 2013); some understand it in connection with high technology, for others it is the process of change, or it is used to mean the application of creativity to solve problems and to explore opportunities (Kirby, 2003). One of the definitions describes innovation as »a new idea for further development of the already existing product, process of method that is related to a specific context in order to create an added value« (OECD, 2012). It is also believed that innovation is strongly connected with creativity, which may contribute to innovation, but on the other hand creativity can also be considered as only a part of the innovation process (Burns, 2011).

When the aim of the research is the innovation in educational practice, the research should be directed in the way to help teachers acquire the necessary knowledge and skills to properly implement innovation. Good ideas developed by either practitioners or researchers or innovation designers need to be spread further on (ibid). However, it often occurs that the designers present certain innovation which is after that not completely or adequately implemented c by the teachers. The question is therefore to what extent is the introduction and implementation of innovation in the educational practice successful (Nachimias, Miduser, Cohenm Tubin & Forkosh-Baruch, 2004). Some (e.g. Dumont, Instance and Benavides, 2010) believe that implementing innovation in education is a major challenge, since educational practice is very resistant to new ideas, teachers usually have strong positions which are difficult to change. This is why it is necessary to understand and to consider the fact that the teachers have an important role in the interpretation of innovation and its implementation into practice (Konings, Brand-Gruwel & Merrienboer, 2007). In this context, the teacher's capacity to undertake research that enables systematic gathering of data about implemented innovation, with the aim of providing a value judgment regarding the innovation or improvement suggestion, is of great importance. Successful innovations are primarily derived from the practice and implemented and evaluated by practitioners, often with the help of other experts (Valenčič Zuljan & Vogrinc, 2010).

2. Innovations in Education

Educational innovations are changes that can apply either to a whole school system or to its components (Pedagoška enciklopedija, 1989). The implementation of the innovation into educational sphere consists of: (1) management of innovations, i.e. economic mechanism or economics innovation and organisational innovation, and (2) production innovations or technological innovations in particular (Yesseyeva & Tuyakayeva, 2012), with the latter being the topic of our interest. Innovations in lessons (Mandič, 1983) include a system of educational, social, organizational and economic measures which are thoughtfully based on educational field, as well as on other scientific fields. They mainly consider introduction and improvement of new learning methods and strategies, learning contents and programs, new school books etc. (Naji, 2009). OECD (2013) identifies three basic areas of innovation in education, namely:

(1) Content (what?)- development of key competences, innovation on specific subject areas such as interdisciplinary programmes, language and multicultural focus, sustainable knowledge;

(2) Resources (what with?) -digital sources and technology on one hand and availability of facilities, infrastructure and learning environments on the other hand;

(3) Teachers (who with?) –inclusion of different experts or colleagues who work with teachers or perform their role, as it is the practice in various innovation studies.

Jorgenson (2006) claims that there are at least three reasons why innovation in education is a must: (1) the number of new research insights into teaching and learning, (2) the ever more complex educational aims and more diverse and demanding learner groups and (3) the pace with which information becomes obsolete. Adjusting to the different interests and needs must lead in development of effective learning and teaching methods (Commission of the European Communities, 2003).

The key aim of educational innovation is a higher quality of educational work (Mandič, 1983; Naji, 2009; Pedagoška enciklopedija, 1989). Teachers' innovations and research work are certainly the important prerequisites of high—quality educational process (Fullan & Hargreaves, 1998; Valenčič Zuljan & Vogrinc, 2010). Innovations in education are not important only because of improving the quality of educational work, it is also vice versa—the school system itself has to foster and develop one's creativity and innovation (Mandic, 1983; Valenčič Zuljan & Vogrinc, 2010). Teachers thus have an excellent opportunity to foster or to impede creativity (Woolfolk, 2001).The implementation of innovation in educational practice is also one of the key components of a teachers' professional development (Bitan-Friedlander, Dreyfus andMilgrom, 2004), and it is again important to stress that the implementation of innovation is only successful when accepted by teachers. It has been proved (Ketelaar, Beijaard, Boshuizen & Brok, 2012) that if the teachers are able to find their own way in putting the innovation into practice, they can feel a high degree of ownership regarding the innovation. In order to prepare good innovation and in order to implement it successfully, the collaboration of practitioners, designers and researchers, is of key importance. Such collaboration that includes research with the final aim of successful implementation of innovation in educational process is one of the basic characteristic of design-based research, which is presented below.

3. Beginnings, Development and Particularities of Design—Based Research

The beginnings of design—based research date back to 1992, when the American psychologist Anna Brown published a paper in the Journal of the Learning Sciences on introducing innovations from the field of educational technology into lessons (Brown, 1992). She claimed that the field of education required research that would successfully bridge the gap between academic research and educational practice, describing this at the time as so—called design experiment research. Later, researchers began using other expressions; the most common expression came to be design—based research (Anderson & Shattuck, 2012). The basic characteristics of this research are found in the article Design—based Research Collective (2003), which was published in the Journal Educational Researcher.

The starting point for the development of design—research was the opinion of certain researchers (National Research Council, 2002 in Design-Based Research Collective, 2003) that researchers, practitioners, and those responsible of the educational policy agree that research in the educational field is somewhat remote from the everyday problems and issues of educational practice. In particular, they highlighted the need for research results to be directly transferable to practice, i.e. for research to solve problems form practice (ibid.). This specific thought led to the development of design—based research, whose primary purpose is to increase the impact of research on practice through a transfer of findings, with the ultimate objective of improving lessons. It also places emphasis on building and forming a theory and on developing principles that guide, raise awareness of, and improve practice and research in an educational context (Anderson and Shattuck, 2012). The founder of design—research, Anna Brown (1992) substantiated the phenomenon and importance of design—based research, highlighting the need to:

- determine how various learning environments impact learning and teaching (ibid.). Learning environment mean those micro-environments or classroom environments that contain the four dimensions: (1) student, (2) teacher and other experts, (3) contents, and (4) equipment and technology (Dumont et al., 2013).

- build a more systematic methodology for implementing the design experiment, which would involve collaboration between teachers and other researchers and help to form a theory to identify various factors that influence the success/failure of the introduced innovation (Brown, 1992).
- to upgrade laboratory research into lessons, with more complex interventions carried out in the demanding and constantly changing environment of the classroom, i.e. to bridge the gap between educational research and the problems present in educational practice (ibid).

The Design-Based Research Collective (2003) labels design-based research as a type of research that combines empirical educational research with a theoretically substantiated shaping of learning environments. Barab and Squire (2004) on the other hand, believe that the purpose of design-based research is to produce new theories, teaching aids, and practices with an impact on learning and teaching in real situations.

3. 1. The Main Characteristics of Design-Based Research

Design-based research is based on a preformed theory, yet at the same time it occurs in real situations, e.g. classroom, and not in a laboratory or in isolation. Incorporating the research into real educational practice means the results can be used to raise awareness and improve practice in a specific learning environment and in other similar environments (Anderson and Shattuck, 2012). Such research is pragmatic, since its purpose is to identify and solve practical problems in lessons and simultaneously contribute to theory and to improving lessons by designing and introducing innovations (Design-Based Research Collective, 2003). There is also talk of intertwinement of the development of theory and the shaping of learning environments (Brown, 1992; Design-Based Research Collective, 2003).

Furthermore, we can label design-based research as interactive and participatory research, as it involves the collaboration of researchers, innovation designers, and practitioners (Anderson and Shattuck, 2011; Cobb, Confrey, di Sessa, Lehrer & Schauble, 2003). This collaboration results from the fact that while teachers are as a rule preoccupied, and usually not qualified to conduct in-depth research, researchers might not be familiar with all the characteristics of educational practice, such as the school culture, school climate, interactions, technology, and general, specific or operative characteristics, which prevents them from preparing an innovation themselves and afterwards from measuring its effect. The combination of factors means a partnership is emphasized, which includes a joint definition of the problem, a review of literature, the designing and producing of innovations, introducing innovations, valuating the introduction of innovations and measuring their effects, and the production and publishing of theoretical and scientific findings (Anderson and Shattuck, 2012). Put simply, researchers and teachers are working together to plan, carry out, analyze, and publish important change to lessons. This means they derive the objectives from both real learning environments and the researcher's interest (Design-Based Research Collective, 2003).

Another of the basic qualities of design-based research is its cyclicality or multiple iterations (multiple circles or steps). According to Anderson and Shattuck (2012) the designing of innovations is like "research through mistakes". Innovations are rarely or never designed and implemented to perfection, meaning there is always room for improvement in their design and for re-evaluation, which is why iterations are necessary. However, such iterations present one of the challenges of this type of research, since it is difficult to know when the research has actually concluded. We could borrow the term "theoretical saturation" (Flick, 2009) and suggest that the research has ended when we can find no new possibilities for complementing the innovations.

Design-based research is integrative, based on various theories connected with the research topic; it can include both descriptive and explicative research methods and a quantitative and qualitative approach, depending on the research requirements. It applies different methods of collecting data

(e.g. observation, writing diary, tests, etc.) and different methods of processing data (e.g. qualitative analysis, and/or statistical processing), with the intention of analyzing the results of the introduced innovation and subsequently refining the innovations (Authors, 2014). The plurality in the use of data processing during iterative cycles is demonstrated in the numerous and various types of data, which thus increase validity, reliability, objectivity and usefulness (Design-Based Research Collective 2003) which are the basic criteria of assessing the quality of research results (Mažgon, 2008).

The basic aim of design-based research is to improve educational practice (Design-Based Research Collective, 2003). It applies that design-based research is particularly suitable for researching possibilities for using new teaching aids, using results to improve practice, "building" common knowledge of designing and introducing innovations and development of human capital.

3.2. The Process of Design-Based Research

The process of design—based research is presented in Diagram 1. The process consists of four consecutive and connected phases, which we adapted after Reeves (in Herrington, McKenney, Reeves and Oliver, 2007).

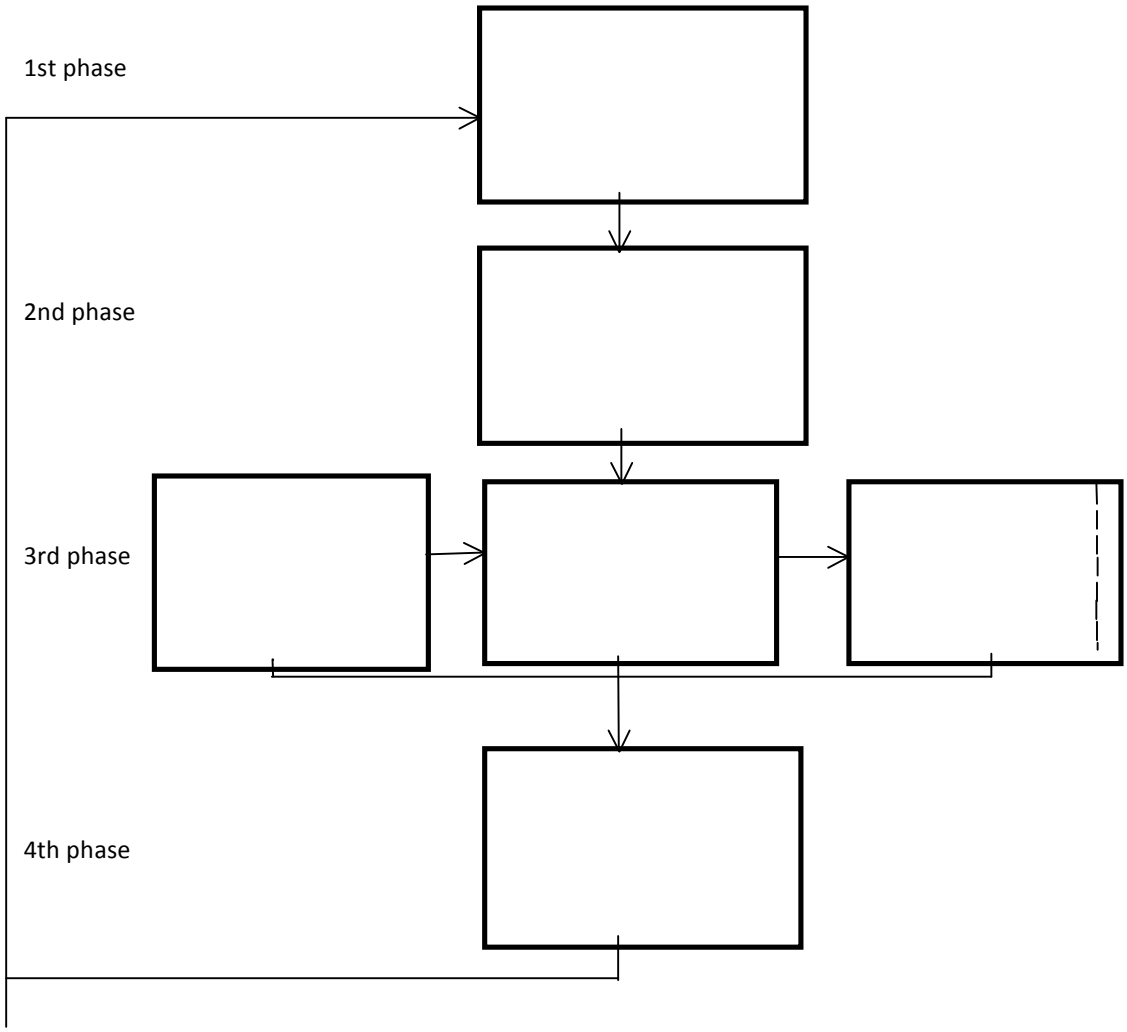

Figure 1. Process of design—based research

The first phase of research encompasses defining the problem, consulting practitioners and researchers, reviewing the literature, and posing research questions or hypothesis. The research problem must be precisely defined, because it is important that relates to an actual problem from practice and an actual search for a solution to an educational problem; the theoretical and practical effect of the research must also be pointed out. Working in collaboration, researchers, practitioners, and experts form, for example, a technical discipline, define the problem precisely. Also necessary is a thorough and systematic literature review, which is crucial in designing the innovations; the literature must be referred to during all phases and in all cyclical iterations (Herrington et al., 2007). Therefore, we can divide this phase into two parts-the definition of the problem and the study of literature-which is often encountered in methodological literature (e.g. Creswell, 2008, Sagadin, 1993).

The second phase encompasses the preparation of a theoretical framework, the development of indicative guidelines for designing innovations, and a description of the innovation proposed for lessons. The innovation (intervention) is designed based on the literature and in collaboration with researchers, practitioners, and designers form specific fields (e.g. computer technology) (Herrington et al., 2007). When planning research, one must contemplate the pattern and method of collecting data (methods, techniques, and potential instruments) and the possibilities for processing data. This, the so-called general plan, must be followed by a more detailed operative or implementation plan (Author, 2009; Sagadin, 1993). In the case of design-based research, researchers must plan thoroughly and consider the persons involved in the research or the sample (the innovation can be introduced in one or several departments), the methods of collecting data-choosing from quantitative (e.g. rating scales, attitude scales, structured observation) and qualitative (e.g. unstructured observation, non-standardized interviews etc.) collection techniques-and, depending on the data, suitable quantitative or qualitative processing. During planning one must consider the potential limitations, such as time, financial resources, and knowledge (Author, 2009); during design-based research, one must think carefully about the selection of collaborators (teachers, researchers, authors of innovations), as such research requires the effective and close collaboration of all members of the research group or team.

The third phase (Herrington et al., 2007) involves the introduction of innovations into lessons (first iteration), those participating in the research, data collection, and analysis, followed by a repeated implementation of innovations into lessons (second iteration and higher), the participants, and the collection and analysis of data. During the implementation phase, one must take into account that design-based research is cyclical, with more iterations and that one implementation alone rarely suffices as an adequate assessment of the success (or failure) of the introduction of innovations into lessons. Design-based research requires at least two iterations, but usually more, and even in every cycle (iteration) one must include the participants and collect and analyze data, and based on the findings go on to implement innovations into lessons anew. After each of the iteration, the learning environment is appropriately added to, thus increasing the possibility of solving the problem. It is about improvement, not argumentation (Reeves in Herrington et al., 2007).

It is also important to realize that design-based research applies both quantitative and qualitative techniques and methods of collecting and processing data. Researchers do not emphasize individual variables, and when researching specific problems and processes they adopt an integral approach (van den Akker in Herrington et al., 2007). They can collect data in cycles lasting several weeks, months, or even years, and the collection methods usually differ between the various research cycles. Thus, one can expect a triangulation of sources of information (e.g. teachers, students, parents), of data collection techniques (interviews, observations, polling), and of researchers (the researcher himself/herself, teachers, assistants or collaborators) (Herrington et al., 2007). The analysis depends on the type of data collected (quantitative or qualitative); one could perform a qualitative analysis (based on coding) or use various statistical methods of quantitative data analysis. The participants are of central importance in the research. Revees (in ibid.) pointed out that design-based research cannot be conducted by a single researcher, as it most often involves a range of students, teachers, parents, technical staff, and others with an interest in the educational process (e.g. representatives of the local community.) The third phase is therefore extremely comprehensive and is divisive into several phases,

for instance the introduction of innovation, collection of data, and the processing and interpretation of data for each individual cycle. The third phase is also implemented in the practice, involving all participants, not only teachers, researchers and designers, the children are actively involved as well.

The fourth phase brings results, solutions to the posed problem, and the final design of innovations in lessons, thus signifying the conclusion of the research. It can include the designing of principles, teaching methods, teaching aids, a designed learning model etc., and concludes with the professional development of those involved. The results can be scientific (design principles), which can encompass different types of knowledge, e.g. procedural and strategic knowledge with a precise illustration of procedures, context, the persons involved in the research, and the systematically collected material (Lincoln & Guba, 1985). The results can be practical or useful, from software to professional development programs (Herrington et al., 2007), and can also be a sort of analyses or structure of activities or the wider institution, or could involve designing the curriculum, a new educational program, textbook, school policy etc. (Design-Based Research Collective, 2003). The products of design-based research, when technology is used to stimulate learning (Mayer, 2010) are often designed by the researcher and developed by programmer or specialist in a specific field. In addition, we must not overlook the social results, e.g. the collaboration and support of the participants (Herrington et al., 2007).

Slovenian researchers have already begun using design-based research (Istenič Starčič, Cotič and Zajc, 2013), namely for researching the effects of introducing technological innovations into lessons, which is why at this point we first present the named research in brief and then we focus on possible uses, advantages and disadvantages.

3.3. An Example of Design-Based Research

In order to make the understanding of design—based research easier, we present an example of design—based research which was conducted by Istenič Starčič, Cotič and Zajc (2013).

The defined *problem* was that children with special needs and children with low fine motor skills often have problems with learning. Especially the children with low fine motor skills have problems when working with computer and using mouse and keyboard. This is why a tangible user interface was developed to learn geometry concepts with the help of computer application. The *aim* of the research was to identify what importance of a tangible user interface can add to teaching and learning. Researchers wanted to know how students, including those with low fine motor skills and those with learning difficulties develop geometry concepts combining cognitive and physical activity. Over a 2-year period 39 teachers and 145 students participated in the research. A didactical application was designed during the first iteration and implemented in inclusive classrooms during the second and third iterations. Qualitative methods were applied: semi-structured interviews, observation of students and teachers, focus groups, teachers, researchers and designers also kept diaries. The research discovered a relationship between diverse students' needs and geometry concept learning in relation to computer-supported learning by tangible user interface. Two dimensions were identified: (a) Tangible user interfaces support concept development, with physical and virtual representations based on dynamic geometry assisted by tangible user interface and (b) tangible user interface manipulative properties support students who have low fine motor skills and difficulties in their geometry learning as well as in their inclusion in classroom activities.

The above case of a design-based research shows that the problem of the research was related to the improvement of work in an inclusive classroom. The research dealt with children with poorly developed motor skills learning geometry. Learning with technology which was tested and improved based on three iterations is important not only for educational practice and educational science; it is also an example of the successful implementation of innovation in teaching geometry.

3.4. Some Advantages and some Disadvantages of Design-Based Research

Design-based research is mainly used because of its advantages (Design-Based Research Collective, 2003). The first advantage is connected with the teachers' involvement in the development of the innovations. If the teachers are involved in the process of innovation, they accept it more easily they consider it is their job to implement innovation successfully.

Additionally, it is believed that in order to come closer to practice, educational research must focus more on the individual elements in various educational situations that are important for learning and consequently for the implementation of innovations, which leads to an improvement of practice in a broader environment. Design-based research can thus contribute to the improvement of the practice through its numerous refinements of innovation in the educational field and with data on the efficiency of these introductions in various learning environments (ibid.).

Design-based research also contributes to understanding the principles of innovation design and the usual procedure for introducing these innovations into lessons. Based on previous research, researchers have numerous examples, models, instructions and principles of introducing innovations at their disposal. These can help a team of researchers in planning and designing innovations and implementing them into practice (ibid.).

Design-based research offers many opportunities for the exchange of knowledge among experts from various disciplines (Cobb, 2001 in ibid.). Those participating in the research are experts from various fields, who become fully acquainted with the research problem within the scope of the research. Moreover, they become acquainted with the theoretical arguments from other fields during the research process and they gain diverse experience in work methods and approaches that their discipline does not necessarily use (Barab and Squire, 2004).

On the other hand, there are also some disadvantages discussed. The first is connected with collecting data (Brown, 1992).The many iterations mean there is a large quantity of collected data, which can only lead to a relatively small contribution to theory. Dede (2004) is critical of the quantity of collected data, and believes that results could be obtained by analyzing merely five percent of it.

Given that in design-based research a researcher is closely integrated in the conceptualization, designing, development, and implementation, and in the entire research process, the question is raised as how to ensure the validity, reliability and objectivity of the research (Barab and Squire, 2004; Anderson and Thusttock, 2012). Advocates of design-based research agree that there is no simple solution, but feel that validity is ensured by partnership of the participants and by multiple iterations, which result in a balancing of theory and practice. Researchers can ensure reliability and objectivity (ibid.) by triangulating sources and data collection techniques, by iterating analyses, and by using standardized data collection instruments.

As previously mentioned, it is characteristic of design-based research to involve a large number of iterations, which can mean years of research that is very rarely adequately supported financially. It is also difficult to develop a vision and management for many years of collaboration and for multi-layered programs, under which much has to be invested in collaboration and relationship. There is also the issue of the persistence of the participants (Anderson and Shattuck, 2012) and the maintaining of a collaborative partnership among the participants within the research context. The research can take several years and is closely connected to the individual views of the participants. Therefore, success most often depends on the ability to collaborate and on the willingness to remain in the partnership (Design-Based Research Collective, 2003).

One of the key drawbacks is also the lack of criteria for deciding whether an innovation should be adopted, rejected, or the subject of further research (Dede, 2004).

4. Conclusion

Innovations and their implementation in educational practice are important factors of improving the quality of educational work, and they also contribute to innovation of all who are involved in educational work. When implementing an innovation, the lack of cooperation between designers and teachers can cause the incomplete implementation of innovation, which presents the lost opportunity for some improvement. Design-based research can lead to an easier and more efficient implementation of innovation. It encompasses the collaboration of researchers, designers and practitioners-teachers. This kind of research embeds teachers in the whole process: from forming the idea to designing, improving and implementing the innovation in practice. It allows the teacher to understand the innovation better, he/she also considers it his own work and he/she has a positive attitude-all these facts enable him/her to implement innovation more efficiently and also to adjust it to the needs of different children.

Design—based research occurs in a genuine educational situation and it connects various disciplines and expertise through the collaboration of practitioners, researchers and innovation designers, thus reducing or eliminating the gap between research in the educational field and the reality of educational practice. It is oriented towards improving the practice or lessons and enriching the theory of a specific field. This form of research has most commonly established itself on the field of researching the introduction of technological innovations into lessons (e.g. the use of information and communication technology), where it does not neglect the students, the teachers, or other collaborators, nor the learning content.

The advantages of design-based research can also be disadvantages. Above all, it presents the challenge of maintaining a relationship and being willing to collaborate over a long period, since, as seen from the example of the research of Slovenian authors (Istenič Starčič, Cotič and Zajc, 2013), this research can take several years. In connection with this, researchers highlight a dilemma regarding criteria for starting, abandoning, or continuing the research into innovations. The advantages and disadvantages of this type of research will be felt most by researchers, practitioners, and innovation designers, who will in the future decide whether to use the research in question; only several direct experiences will enable a final assessment of the foundation and usefulness of design-based research.

References

Commission of the European Communities. (2000) *A Memorandum on Lifelong Learning.* http://www.bologna-berlin2003.de/pdf/MemorandumEng.pdf

Anderson, T., & Shattuck, J. (2012). Design-Based Research: A Decade of Progress in Education Research?", *Educational Researcher,* 4(1), 16-25.

Barab, S., & Squire L. (2004). Design-Based Research: Putting a Stake in the Ground", *The Journal of the Learning Sciences, 13*(1), 1-14.

Bitan—Friendlander, N., Dreyfus, A., & Milgrom, Z. (2004). Types of »teachers in training«: the reactions of primary school science teachers when confronted with the task of implementing an innovation", *Teacher and Teacher Education, 20,* 607—619.

Brown, L. A. (1992). Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings", *Journal of the Learning Sciences, 2*(2), 141-178.

Burns, P. (2011) *Entrepreneurship and small business: Start-up, growth and maturity*, Hampshire, Palgrave Macmillan.

Author. 2009. [details removed for the peer review]

Cobb, P., Confrey, J., di Sessa, A., Lehrer, R., & Schauble, L. (2003). Design Experiments in Educational Research", *Educational Researcher, 32*(1), 9-13.

Creswell, W. J. (2008). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research,* New Jersey, Pearson Prentice Hall.

Dede, C. (2004). If Design-Based Research is the Answer, what is the Question?"*Journal of the Learning Sciences, 13*(1), 105-114.

Design-Based Research Collective (2003). Design-Based Research: An Emerging Paradigm for Educational Inquiry", *Educational Researcher, 32*(1), 5-8.

Dumont, H., Istance, D., & Benavides, F. (2010). *The Nature of Learning: Using Research to Inspire Practice,* Paris, OECD.

Flick, U. (2009). *An Introduction to Qualitative Research,* London, Sage Publications.

Fullan, M., & Hargreaves, A. (1998). *What's worth fighting for in your school*, Buckingham, Open University.

Herrington, J., McKenney, S., Reeves,C. T., & Oliver, R. (2007) *Design-Based Research and Doctoral Students: Guidelines for Preparing a Dissertation Proposal.*http://ro.ecu.edu.au/cgi/viewcontent.cgi?article=2611&context=ecuworks

Istenič Starčič, A., Cotič, M., & Zajc, M. (2013). Design-Based Research on the Use of a Tangible User Interface for Geometry Teaching in an Inclusive Classroom", *British Journal of Educational Technology*, 5, 729-744.

Jorgenson, O. (2006). Why Curriculum Change is Difficult-and Necessary, *Independent School, 6*(4), 66-79.

Ketelaar, E., Beijaard, D., Boshuizen, H. P. A., & Den Brok, P. J. (2012). Teachers' positioning towards and educational innovation in the light of ownership, sense-making and agency". *Teaching and Teacher Education,* 28, 273-282.

Kirby, A. D. (2003). *Entrepreneurship*, London, McGraw Hill Education.

Konings, D. K., Brand—Gruwel, S., and van Merrienboer, J. J. G. (2007). Teachers' perspectives on innovations: Implications of Educational Design", *Teaching and Teacher Education*, 23, 985—997.

Likar, B. (2013) *Innovation Management*, Ljubljana, Corona plus—Institute for Innovation and Technology.

Lincoln, S. Y., & Guba, E. G. (1985). *Naturalistic Inquiry*, London, New Delhi, Sage Publications, Ltd.

Mandič, P. (1983) *Inovacije pri pouku* [Innovations in lessons], Ljubljana, DZS.

Mayer, E. R. (2010). Učenje s tehnologijo, in H. Dumont, D. Instace and F. Benavdes F (Eds.), *The Nature of Learning: Using Research to Inspire Practice,* OECD, Paris, 163-183.

Mažgon, J. (2008) *Razvoj akcijskega raziskovanja na temeljnih predpostavkah kvalitativne metodologije,* Ljubljana, Filozofska fakulteta.

Nachimas, R., Mioduser, D., Cohen, A. Tubin, D., & Forkosh—Baruch, A. (2004). "Factors Involved in the Implementation of Pedagogical Innovations Using Technology. *Education and Information Technologies", 3,* 291—308.

Naji, M. (2009). Inovacije v šolstvu ter evropsko leto inovativnosti in ustvarjalnosti [Innovation at School and the European Years of Innovativeness and Creativity]. *Šolski razgledi* 16 January 2009. http://www.razgledi.net/2009/01/16/inovacije-v-solstvu-ter-evropsko-leto-inovativnosti-in-ustvarjalnost

OECD. (2012). *Teaching Practices and Pedagogical Innovation. Evidence from TALIS*. OECD Publishing.

OECD. (2013). *Educational Research and Innovation, Innovative Learning Environments*. OECD Publishing. Retrieved on 10th May 2014 from: http://dx.doi.org/10.1787/9789264203488-en

Pedagoška enciklopedija [Educational Encyclopaedia]. (1989) Beograd, Zavod za udžbenike i nastavna sredstva.

Sagadin, J. (1993) *Poglavja iz metodologije pedagoškega raziskovanja* [Selected Chapters of the Educational Research Methodology], Ljubljana, Zavod Republike Slovenije za šolstvo in šport.

Authors. (2014) [details removed for the peer review]

Valenčič Zuljan, M., & Vogrinc, J. (2010). The Factors of Encouraging Teacher Innovation from the Perspective of Teachers and Headmaster" in Valenčič Zuljan, M. and Vogrinc, J (Eds.), *Facilitating Effective Student Learning through Teacher Research and Innovation,* Faculty of Education, Ljubljana, 455-469.

Woolfolk, H. A. (2001). *Educational psychology,* Boston, Allyn and Bacon.

Yesseyeva, M., & Tuyakayeva, D. (2012). Search and Implementation of Innovation in Educational Institutions.",*Procedia – Social and Behavioral Sciences, 69*, 1118-1121.