
Subject didactics research

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Summary and selected outcomes:

The research focuses on developing theories and research in subject didactics on the basis of a common (trans?didactic) approach to teaching and learning, which includes three basic interrelated research areas: (1) didactic transformation of content; (2) teachers' ability to think about, plan and reflect teaching; and (3) pupils' ideas, preconceptions and other determinants influencing content acquisition and learning.

1 Theory of didactic transformation of content for teaching and research on learning environments and assessment of its quality

The aim of research work in this area is to analyse, describe and explain the personal, social and cultural conditions and intentional learning processes of pupils at school and based on that, to formulate suggestions and recommendations to improve educational practice, especially through the professional training of teachers.

Processes of didactic transformations of content are analysed and interpreted with regard to the degree of so-called cognitive activation of pupils, i.e., with respect to the active motivated formation of pupil's knowledge. Cognitive activation of pupils is one of the key determinants of teaching which determines the degree of quality of education; therefore, it is one of the most important categories (or variables) which justify subject didactic or trans?didactic research.

Examples of outcomes:

The theory of cultural development of science based on the analysis of (mis)understanding between the language of the science and language of everyday experience.

- KVASZ, L. Über die Konstitution der symbolischen Sprache der Mathematik. In KADUNZ, G. (Ed.), Semiotische Perspektiven auf das Lernen von Mathematik (51-67). 1 vyd. Berlin: Springer Spektrum, 2015. ISBN 978-3-642-55176-5.
- NOVOTNÁ, J. - SARRAZY, B. Learning: Creation or Re-creation? From Constructivism to the Theory of Didactical Situations. In D. Ambrose, B. Sriraman, K. M. Pierce (Eds.), A Critique of Creativity and Complexity. Deconstructing Clichés (19-33). Rotterdam/Boston/Taipei: Sense Publishers, 2014. ISBN 9789462097711.
- EISENMANN, P. - NOVOTNÁ, J. - PŘIBYL, J. - BŘEHOVSKÝ, J. The development of a culture of problem solving with secondary students through heuristic strategies. Mathematics Education Research Journal, 2015, 27(4), 535-562. ISSN: 1033-2170 (Print) 2211-050X (Online). DOI 10.1007/s13394-015-0150-2.
- HNÍK, O. Didaktika literatury: výzvy oboru: od textů umělecké povahy k didaktice estetickovýchovného oboru. Praha: Karolinum, 2014. 179 s. ISBN 978-80-246-2626-0.
- ČERNOCHOVÁ, M. Philosophy and Computing. In Introducing Computing. (Ed) Lawrence Williams. Routledge. Taylor and Francis.CPI Group (UK) Ltd, Croydon, 2015. ISBN 978-1-138-02284-3. pg 53-76.
- TICHÁ, M. The Aims of Economic Education and Purpose of Economic Activity. In Philosophy of Education. Scientific journal. Special issue. No 6/2013. P. 48-56. ISSN 1811-0916.
- FULKOVÁ, M. et al. *Muzejná a Galérijní Edukace 1 a 2. Vlastní cestou k umění/Učení z umění*. Praha: Univerzita Karlova v Praze, Pedagogická fakulta/Uměleckoprůmyslové museum v Praze, 2012 / 2013.
- FULKOVA, M. - TIPTON, T. Zde Jsem. Here I Am. In Mason, R., Buschkuhle, C.P. (Eds. (2013). *Images & Identity. Educating Citizenship through Visual Arts*. Bristol, Chicago: Intellect. ISBN 978-1-84150-742-2.
- UHL SKŘIVANOVÁ, V. Vergleichende Pädagogik als Basis der internationalen Forschungen und Dokumente.BUKO15 Blinde Fleken. Internationaler Kongress der Kunstpädagogik 2015. 13.-15. Februar in Salzburg. Bökwe 4. 2015. S. 218-221.

2 Research on and theory of teachers' conduct and thinking in leading, planning and reflecting teaching

The aim of research in this area is to understand the phenomena which determine the quality of teachers' didactic impact on pupils in teaching. It is based on three key constructs: (1) professional vision, (2) reflective competence as a part of

professional competence, (3) didactic knowledge of content. We perceive such constructs as a mental framework which falls within the context of reflections and discussion on teacher training, on the development of their professionalism and improvement of the quality of teaching through reflection on practice.

Examples of outcomes:

- VONDROVÁ, N. - ŽALSKÁ, J. Ability to Notice Mathematics Specific Phenomena: What Exactly Do Student Teachers Attend to? *Orbis scholae*, 2015, 9(2), 77-101. ISSN 2336-3177 (Online), ISSN 1802-4637 (Print).
- ODCHÁZELOVÁ, T. Beliefs of the biology teachers about using multimedia. *Problems of Education in the 21st Century*, (63)63, 2015, s. 71-83.
- RUSEK, M. - METELKOVÁ, I. Chemistry Teachers' Opinion of Chemistry Education. In P. Cieśla & A. Michniewska (Eds.) *Teaching and Learning Science at All Levels of Education*. Krakow: Pedagogical University of Krakow, 2014.
- ROBOVÁ, J. - VONDROVÁ, N. Students teachers' ability to interpret numerical results in GeoGebra. In Krejčí, I., Flégl, M., Houška, M. (Eds.), *Proceedings of the 12th International Conference Efficiency and Responsibility in Education (468-476)*. Prague: Czech University of Life Sciences Prague, 2015. ISBN 978-80-213-2560-9. ISSN 2336-744X.
- NOVOTNÁ, J. - JANČÁŘÍK, A. - RUSEK, M. Stem and project-based education. In D. Rychtarikova, D. Szarkova & L. Balko (Eds.). *APLIMAT 2016 - 15th Conference on Applied Mathematics 2016*, Proceedings (876-885).
- STARÁ, J. - KRČMÁŘOVÁ, T. How teachers reflect on textbook materials and how they utilise them. *IARTEM e-Journal*, 2014, 6(3), 67-86. ISSN: 1837-2104.
- FULKOVA, M. - TIPTON, T. DNA as a Work of Art: Processes of Semiosis between Contemporary Art and Biology', *The International Journal of Art & Design Education*, Volume 32, Issue 1, February 2013. Pp. 83-96. ISSN 1476-8062.

3 Research on and theory of pupils' ideas and the development of their understanding content to be learned

Research in this area is influenced by the contemporary culture of teaching and learning which draws inspiration from social and pedagogical constructivism. In it, the pupils' ideas (preconceptions) are related to the activities with the curriculum by one of the key entry conditions of intentional learning because their inter-subjective diversity encourages critical discussion and thinking about the studied content and motivates its cognition.

The aim of research into pupils' ideas is therefore to gain understanding of the didactically functional relationship between the development of ideas, the quality of activities and the improvement of competencies in socially conditioned learning.

Examples of outcomes:

- HEJNÝ, M. Exploring the cognitive dimension of teaching mathematics through scheme-oriented approach to education. *Orbis scholae*, 2012, 6(2), 41-55. ISSN 2336-3177 (Online), ISSN 1802-4637 (Print).
- HÁJKOVÁ, E. et al. Children's preconceptions within the educational framework of Czech language, research conclusions. *PedF UK*, Praha 2015. ISBN 978-80-7290-847-9.
- ŠTĚPÁNÍK, S. Příklad výzkumu žákovských představ v české syntaxi. *Pedagogická orientace*. 2014, 24(1): 111 –127.
- ŠTÍPEK, J. - RAMBOUSEK, V. - PROCHÁZKA, J. Primary findings of the research on ICT literacy education pupils' and teachers' ICT competencies in primary and lower secondary schools. *Journal on Efficiency and Responsibility in Education and Science*, 2013, 6(4), 245-264. ISSN 1803-1617. DOI 10.7160/eriesj.2013.060403
- ULIČNÁ, K. Hodnocení interkulturní komunikační kompetence: adaptace a ověření psychometrických vlastností české verze dotazníku YOGA. *Pedagogika*, 2015. 65(4): 413–433.
- VONDROVÁ, N. - RENDL, M. - HAVLÍČKOVÁ, R. - HŘÍBKOVÁ, L. - PÁCHOVÁ, A. - ŽALSKÁ, J. Kritická místa matematiky základní školy v řešených žáků. Praha: Karolinum, 2015, 464 s. ISBN 978-80-246-3234-6, ISBN 978-80-246-3252-0 (pdf).
- NOVOTNÁ, J. - HOŠPESOVÁ, A. Traditional versus Investigative Approaches to Teaching Algebra at the Lower Secondary Level: The Case of Equations. In Leung, K.S., Park, K., Holton, D., Clarke, D. (Eds.), *Algebra teaching around the world (59-80)*. Rotterdam / Boston / Taipei: Sense Publishers, 2014. ISBN 978-94-6209-706-3.