

# **Analysis of Learning Situations Developing the Problem-solving Competence in Primary Science Instruction**

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REPUBLIC

# Aim of the presentation

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- to present my home Institute
- to present my research design

## Structure of the presentation

Background

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Problem task

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# FACULTY OF EDUCATION Masaryk University



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# History of the faculty in dates

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**1918** - **Establishment of the faculty of education (or teaching faculty)** *was discussed for the first time* as part of preparation of the Act at Masaryk University.

**1945** - *Decree of the President of the Czechoslovak Republic on education of teachers No 132/1945 Coll.* was issued.

**1946** - *The Faculty of Education, MU was founded*; its first Dean was František Trávníček.

**1948** - **First professors of the faculty were appointed**

**1950** - Long-distance study was arranged for teachers in active service.

**1959** - Transformation of the Higher School of Education into the Teacher Training College.

**1964** - **Restoration of the Faculty of Education.**

**1977** - *Reform of study* – introduced study of teaching subjects of general education for secondary schools as well.

**2014** - *Ceremonial opening of the new building CVIDOS*

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# Study Programmes

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## **Bachelor programmes graduates**

work as a *teaching assistant* to a teacher at primary and lower secondary schools

work as *instructors* in leisure centres

graduates are prepared for *socially-educative work with people* of all ages and from all social groups

graduates are prepared for activities in *special education* in special kindergartens

## **Master programmes graduates**

acquiring a *teacher qualification in a chosen specialization* for elementary, lower secondary and secondary schools and schools for learners with special study needs

## **Graduates from doctoral programmes**

*academic staff at universities* – in the fields of pedagogy, and research in education  
professional careers in the *public sector* or in *company management*

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# Doctoral studies at the Faculty provided in the following programs:

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- study programme Pedagogy – field Pedagogy
- study programme Special Education – field Special Education
- study programme Special Education – field Special Education (taught in English)
- study programme Special Education – field Special Education (taught in German)
- study programme Specialization in Pedagogy – field Art
- study programme Specialization in Pedagogy – field Art (taught in German)
- study programme Specialization in Pedagogy – field Foreign Language  
Curricular Studies
- study programme Specialization in Pedagogy – field Theory of Music and  
Pedagogy

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# Departments & Institutes

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<http://www.ped.muni.cz/en/about-the-faculty/departments-and-institutes>

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# Institute for Research in School Education



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# Institute for Research in School Education

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The motto of the institute:  
*better education through research*

Doc. PhDr. Tomáš Janík, Ph.D., M. Ed.

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# Main Research Themes

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- Classroom processes
- Teacher education
- Curriculum

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# International cooperation of IRSE

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- [Lehrstuhl für Schulpädagogik und Didaktik, Friedrich-Schiller-Universität Jena, Deutschland](#) – area of research of emotions, organising joint workshops and conferences, joint publications, academic stays (Prof. Dr. Michaela Gläser-Zikuda).
- [IPN – Leibniz-Institut für die Pädagogik der Naturwissenschaften und Mathematik an der Universität Kiel, Deutschland](#) – area of video-based methodology, organising joint workshops and conferences, joint publications, academic stays (Dr. Inger Marie Dalehefte, Dr. Mareike Kobarg).
- [School of Education, Technische Universität München, Deutschland](#) – area of methodology of video-based research and using video in teacher education, joint publications (Prof. Dr. Tina Seidel).
- [Interfakultärer Fachbereich Sport- und Bewegungswissenschaft an der Universität Salzburg, Österreich](#) – area of research on curriculum and instruction in physical education, joint publications, academic stays (Prof. Dr. Rudolf Stadler).
- [National Institute for Education, Slovakia](#) – expertise and cooperation in curricular research and development (Doc. Dr. Viliam Kratochvíl).

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The focus of the IRSE is put on the pedagogical methodology, especially the relation between the theory and practice, general didactics and subject didactics, mixed methods, video-based methodology, comparative methodology in the research of curriculum and the contrastive approaches in the research of teacher education.

- Between acceptance and resistance: Teachers' perceptions of curricular changes 10 years into the reform implementation
- Classroom interaction in English language teaching in higher education
- Producing pedagogical knowledge for improvement: altering teaching situations for the better
- Exploring professional vision and its development through video-based analysis (from the perspective of teachers of English as a foreign language)
- An Expert Teacher: his/her characteristics and the determinants of his/her professional development (in the context of foreign language teaching)
- Opportunities to develop problem solving competence in textbooks and in the classroom

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# Institute for Research in School Education

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# Analysis of Learning Situations Developing the Problem-solving Competence in Primary Science Instruction

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## Background

- the Czech educational system has undergone a curricular reform
- emphasis on pupils' key competencies

↓  
problem-solving competence

↓  
PS competence in primary Science instruction

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- A lot of critique concerning the concept of competences (e.g. Willbergh, 2015; Westera, 2001)
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- Our approach: competences as a *vehicle* for bringing or developing constructivist approaches,
    - they must be connected to a subject matter,
    - as a transfer is one of their main characteristic (c.f. Barrows, 1996, Delisle, 1997) they elicit higher order thinking
  - In PS competence we can see the problem as a motor of the *vehicle* we have concentrated on problem tasks (resp. problem learning situations) in the primary instruction

# What's the problem?

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- Problem – a discrepancy between an actual and goal state which we are motivated to discharge. In order to solve the problem we have to use operations so that we could eliminate all constraints (cf. Chi & Glaser, 1985, p. 229, Jonassen, 1997, Lipták, 1987, p. 26, comp. Getzels, 1982, p. 40–41).
- Cognitivist psychologists divide problems into well- and ill-structured ones (Jonassen, 1997).
- Ill-structured problems possess multiple solutions, solution paths, fewer parameters which are less manipulable and contain uncertainty about which concepts, rules and principles are necessary for the solution or how they are organized and which solution is the best (Jonassen, 1997, p. 65).
- **Problem task** – a task that contains an ill-structured problem



# Aims of the Thesis

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- to describe how learning situations that develop the problem-solving competence in primary Science education are used in real instruction as captured by a video study

(1) to analyse the learning situations that develop problem-solving competence in primary Science instruction (identification and description)

(2) to suggest alternative approaches to the analysed learning situations in order to increase their potential for developing the problem-solving competence

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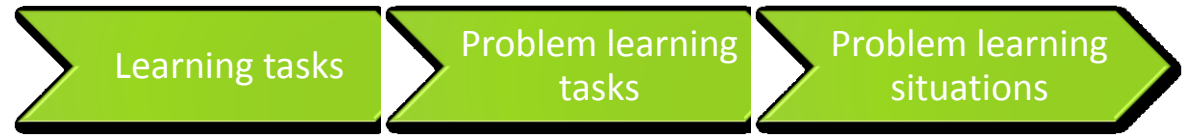
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# Research design



**Learning task** - any question or a command calling for/eliciting a learning activity

**Problem learning task** – As PBL is characterized as follows: learning is student centred,

- occurs in small groups,
- teachers are facilitators and guides,
- form the organizing focus and stimulus for learning,
- new information is acquired through self-directed learning,
- learning is based on a problem connected to real life and has an interdisciplinary character  
(Barrows, 1996, pp. 5–6),

thus we consider a problem learning task as a task that:

- must:
1. be connected to a real life
  2. contain an ill-structured problem
  3. have an interdisciplinary character
- may (at least one of these characteristics):
4. teacher is just a facilitator
  5. contain a system of follow-up tasks
  6. be solved in groups
  7. be open-ended or be divergent

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# Problem Learning Situation

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**Problem learning situation** – contains a problem task, based on PBL approach; see [the model of PLS](#)

My characterisation of PLS follows the 3A methodology – a developing „hospitation“ built on an analysis that follows the methodological inputs from research based on video-recordings (Janík et al., 2013, pp. 218—245). That consists of Annotation, Analysis and Alteration.

Annotation – brings basic information about the topic, foregoing activities, didactic processing of subject matter, activities of pupils



Analysis – investigates the PLS more deeply from the angle of aims – in my Thesis PS competence



Alteration – brings an evaluation of quality of the situation and a suggestion of potentially better alternatives

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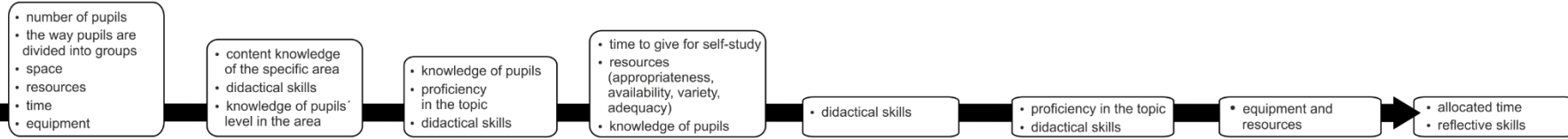
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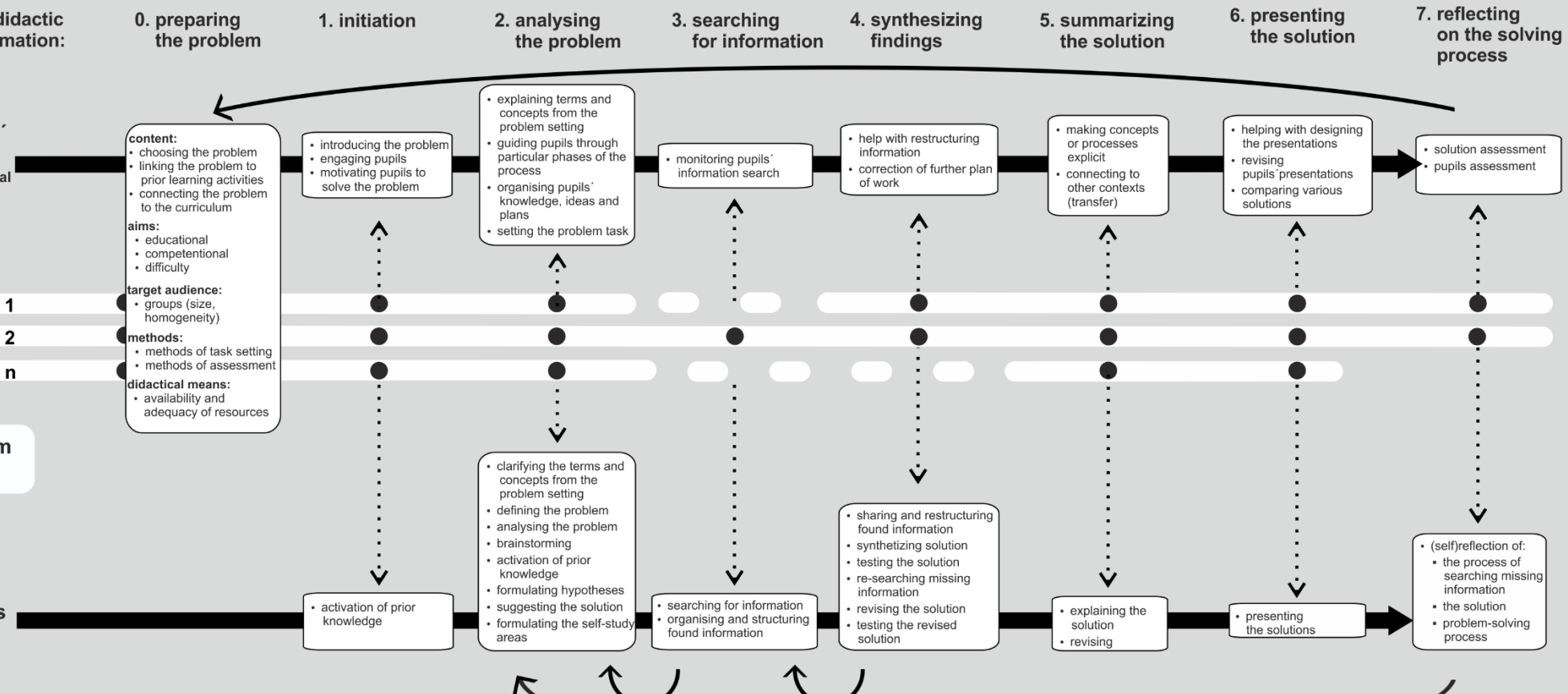
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## extrinsic situational circumstances



## intrinsic situational circumstances



1. **Structured annotation** – describes how is PT approached, oriented mainly on intrinsic situational circumstances that can be changed during the process:

Characteristic	Phase which it occurs in
(1) <b>Topic</b> of the PLS	P0
(2) <b>Link to the foregoing LS</b> – the story of the lesson	P0
(3) <b>Learning phase</b> in which the PLS is situated (revision, introduction, presentation of new subject matter, exercising, application, recapitulation, examining/assessing and others – based on Seidel, Prenzel, & Kobarg et al., 2005, adapted by Najvar et al., 2011)	P0
(4) <b>Organisation form</b> (whole-class, individual work, pair work, group work, more forms together, other – adapted from Janík and Miková, 2006)	P1-P7
(5) <b>Placement in the classroom</b> (in the desk, in front of the blackboard, on the carpet, anywhere in the classroom, changing, outside the classroom – Češková, 2014)	P1-P7
(6) <b>Didactical means</b> (without any, blackboard, worksheet, exercise book, textbook, book, model/realia, picture/map/cards, audio, video, ICT, other - adapted from Janík et al., 2007)	P1-P7

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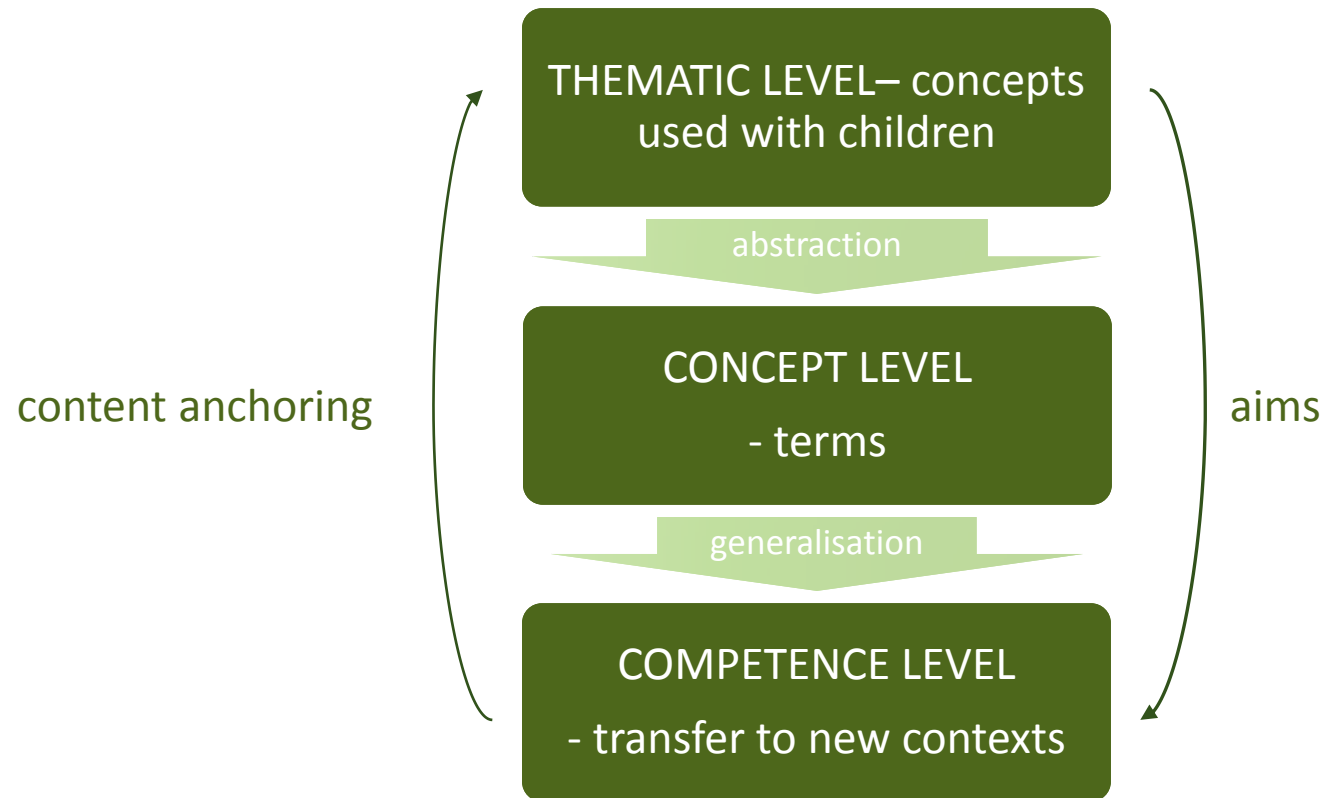
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## 2. Structured analysis:

(7) **Concept diagram** – shows a schematic model of subject matter – shows concepts (contents) and main relations among them (based on Janík et al., 2011, p. 103)

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**(8) Phases of PLS** - based on PBL process (Delisle, 1997; Edens, 2000; Hmelo-Silver & DeSimone, 2013; Hung, Jonassen, & Liu, 2007; Kličková, 1989; Maňák & Švec, 2003; Schmidt, 1983; Segers, 1997; Tchibozo, 2011; Torp & Sage, 2002; Zumbach, Kumpf, & Koch, 2004).

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Phase 0 – Problem structuring – Teacher judges external and internal situational conditions and designs the problem.

Phase 1 – Initiation – Teacher poses preparatory tasks connected to the issue developed in PST and motivates pupils.

Phase 2 – Analysing the problem

Phase 3 – Searching for information

Phase 4 – Synthesizing findings

Phase 5 – Summarizing the solution

Phase 6 – Presenting the solution

Phase 7 – Reflecting on the solving process

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## 3. Alteration

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- **Assessment of the quality**
- **Suggestion** – creating of the potentially better alternatives
- **Re-consideration** – Does it work? Where might be a problem?

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Thank you for attention!

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