

## REASON Spring School 2018 Poster Session III

### REASON Spring School 2018 Poster - Session III, Wednesday 7.03.2018

#### III-1 **Teaching Assessment Competence in Social work with Flexible Computer Supported Scripts and Reflection Prompts**

Opio Mary, Birgit Dorner and Ingo Kollar

Computer supported scripts (CSS) are scaffolds (instructional interventions) which provide learners with external guidance regarding when, how and in what sequence to perform certain activities (Kollar, Fischer, & Hesse 2006). Research from the Learning Sciences show that instructional interventions (scaffolds) can be used to support learners acquire Domain specific skills (Fischer, Kollar, Stegmann & Wecker, 2013). The aim of our study is to examine how computer support scripts can be used to teach assessment competence following the step by step approach suggested in the general normative behavioral theory of social work (Geiser, 2013). According to the general normative behavioural theory of social work, social workers answer specific questions which help them generate different forms of knowledge about a problem situation. Social workers ought to reflect on these different forms of knowledge which makes reflection an important subskill in assessment. We build on Wang, Kollar and Stegmann (2017) 's research which suggests that adaptability can be used to realize the flexibility of computer supported scripts and the research of Davis (2003) which shows that the form of reflection instruction influences how productive students reflect to raise following research questions: 1) What is the effect of computer-supported scripts (strict/flexible strict) on student 's assessment competence? 2) What is the effect of reflection prompts (specific/generic) on student 's assessment competence?

Method: We create a 2x2 quasi experiment, with the independent variables (1) computer-based script (strict vs. flexible) and (2) reflection prompts (specific vs. generic) and we use a computer documentation software to offer instruction. In our pre-post-test design, students receive four case vignettes to stimulate their engagement in child welfare assessment. We expect flexible scripts to increase assessment competence more than stable scripts. Specific prompts should increase assessment competence more than generic prompts. Combining flexible scripts with specific prompts is expected to yield the highest increases in assessment competence.

#### III-2 **Fostering Collaborative Diagnostic Competences of Medical Students by Using Simulations**

Anika Radkowitzsch, Frank Fischer, Martin Fischer and Ralf Schmidmaier

In their daily practice, physicians with different professional backgrounds often collaboratively diagnose a patients' disease. In those situations, physicians not only need to be able to diagnose individually, but also need additional collaborative competences. Empirical findings indicate that physicians particularly have difficulties to share unshared information (e.g., Tschan et al., 2009). Hence, we primarily seek to analyze instructional methods to foster collaborative diagnostic competences within a simulation based learning environment. In the simulated situation a learner in the role of an internal specialist will need to consult a simulated radiologist to diagnose complex cases of patients suffering fever. As complex learning environments demand for additional instructional support, learners will be provided with socio-cognitive collaboration scripts (Fischer, Kollar, Stegmann, & Wecker, 2013) to support the collaborative processes and with structured reflection (Mamede et al., 2014) to support the diagnostic competences. To examine the effectiveness of the scaffolding methods, three studies are planned. Firstly, a validation of the patient cases and learning environment will be conducted. Secondly, two distinct types of collaboration scripts (adaptive versus non-adaptive collaboration scripts) will be contrasted to a control group. Thirdly, the collaboration script that worked best in Study 2 to will be combined with structured reflection in a two-factorial design. A detailed overview of the project as well as results of a first examination of the learning environment with respect to its authenticity, learners' involvement, and the measurement of diagnostic competences will be presented.

#### III-3 **Elementary students' conditional reasoning skills in mathematical & everyday context**

Datsogianni Anastasia, Stefan Ufer and Beate Sodian

Reasoning about conditional "if..then" statements is a central component of logical reasoning (Inglis & Simpson, 2009), referring to a semantic process based on the construction and manipulation of mental models (Johnson-

Laird & Byrne, 2002). However, are elementary school children able to engage in conditional reasoning? Research in developmental psychology has shown that even very young children possess basic abilities in (at least some forms of) conditional reasoning when tasks are presented in an everyday context (e.g. Markovits & Thomson, 2008), while there is a great deal of variation in performance due to external factors. Nevertheless, a link between conditional reasoning and mathematics can be found only in the case of late adolescence and adults (Attridge & Inglis, 2013; Inglis & Simpson, 2009). Given this early start of the development of every-day conditional reasoning skills and the lack of research with primary students in mathematics education, it is a desiderate to analyse and describe the development of conditional reasoning in mathematics even at younger ages. In addition, in this study we investigate the effect of problem context to see the extent to which every-day conditional reasoning skills can be transferred, and thus related to, conditional reasoning skills on mathematical concepts. Given that current theories describe conditional reasoning as a process that involves domain-specific knowledge, it is also an open question to which extent conceptual knowledge of mathematics determines students' conditional reasoning skills in mathematics. Results from a first empirical study on elementary students from Germany and Cyprus, will be presented at this Spring School.

### III-4 **Promoting inquiry learning in digital simulation environments by metacognitive scaffolds**

Anna Horrer, Maria Bannert and Freydis Vogel

In conjunction with inquiry learning in classrooms, students who are encouraged in engaging in scientific reasoning and argumentation may enhance their skills such as problem solving, deeper processing of information, and a thorough understanding of scientific research questions.

As inquiry learning by conducting realistic experiments in science classrooms is not always feasible and underlies multiple constraints, it can be more easily realized by help of simulations for science education.

Despite the considerable advantages of this teaching approach, experience shows that learning with digital simulations may not be sufficient in promoting acquisition of knowledge and skills on multiple dimensions, but needs to be further scaffolded to unfold its full potential. For instance, adapting metacognitive learning activities is crucial for learners to focus on task-oriented self-regulation strategies while learning with digital simulations. Nonetheless, these strategies are merely performed successfully by students autonomously.

This study seeks to examine how metacognitive scaffolds for learning with simulations should be designed to provide productive guidance through the phases of inquiry learning as compared to unguided learning with simulations. Furthermore, this study aims to investigate how scientific reasoning can be stimulated in a digital inquiry learning environment by metacognitive scaffolds.

Yet, many empirical studies on learning are conducted in laboratory settings and therefore do not represent the realistic learning environment in the ecosystem of a school. Thus, this study strives for external validity of inquiry learning research results by implementing the simulations into a naturalistic classroom context.

### III-5 **Assessing digital literacy in teachers: development and validation of a test instrument**

Viktoriiia Makarenko, Lana Husagic, Ulrike Franke, Michael Sailer and Frank Fischer

Background: As technology enters schools, it becomes more and more important to ensure a quality integration of it into the school curriculum. Today, digital literacy is one of the core skills to acquire at school age. To ensure students develop digital literacy skills, we need to make sure teachers have the skills they are expected to teach, in conjunction with the competences that will allow them to integrate technology successfully into their classroom. To take action, an instrument which reliably allows teachers to determine their level of digital literacy is needed. Thus, the aim of the present study is to develop and validate a self-assessment instrument, providing insight into pedagogical technological knowledge, digital literacy competence and reasoning processes of teachers.

Methods and Results: The self-assessment instrument is based on the key feature problems (Bordage and Page, 1987). The sample will consist of Bavarian in-service teachers who will fill in the test online. We will run confirmatory factor analysis (CFA) to confirm the existence of 4 distinguishable factors in the model: planning, implementing, evaluating and sharing. We will also apply item analyses to evaluate the internal consistency of the self-assessment scale. Standardized examination scores, item response number, item response time, and an interaction term between item response number and item response time will be used as predictors of item performance (correct/incorrect) in a multiple logistic regression analysis.

The instrument is currently in its final development stage; results will focus on the ecological validation of the tool.

### III-6 **Assessment and Training of Experimentation Skills in primary school students**

Sonja Peteranderl, Anne Deiglmayr and Elsbeth Stern

This project focuses on the assessment and training of experimentation skills in primary school students. Experimentation skills comprise the ability to design conclusive, un-confounded experiments, and to interpret and evaluate the obtained data. They represent a core component of scientific reasoning. The particular focus of my project is on the "control of variables" strategy (CVS), a core skill in planning, conducting, and evaluating scientific experiments for testing causal hypotheses. An experimentation skills training and a suitable paper-based test with the aim to foster children's understanding and application of CVS have been developed and are empirically evaluated. Students within a class are randomly assigned to either The Experimentation Skills Training (EST) or an Active Control Training (ACT). The EST focuses on scientific experimentation and CVS, whereas the ACT focuses on conceptual knowledge and no CVS. The Experimentation Skills Test assesses several subskills of CVS with 5 different items types. Additionally, it addresses prevalent misconceptions in designing conclusive experiments such as testing the wrong hypothesis testing multiples hypotheses at once, or designing experiments based on a desired outcome (engineering model). Furthermore, we assess transfer of CVS to complex problem solving (assessed by using a computer-based test), and to future conceptual physics learning. Data collection in a longitudinal study design is still going on. First results from 8 classes (n = 152) already show satisfying psychometric qualities of the test scales, and indicate that the training is effective in increasing students understanding and application of the CVS, and in reducing their misconceptions.

### **III-7 Promoting scientific reasoning skills in teacher education: preconditions and challenges** Annika Diery and Freydis Vogel

Evidence-based practice is required for professional decision-making and behavior of teachers. In general, this means that teachers take relevant findings and theories of educational research into consideration in a professional manner and use them for reasoning and reflecting their actions in teaching practice. The structured presentation of educational research findings (e.g. "What Works Clearinghouse", "Clearing House Unterricht") seems to be a promising first way to support pre-service teachers' acquisition of scientific reasoning skills. However, the practicability of this approach underlies multiple constraints, e.g. motivational and attitudinal aspects of the teachers, knowledge about science in general and intelligibility of science. In order to promote skills in scientific reasoning and evidence-based practice in the field of teacher education in general, two perspectives might be important: the perspective of the teacher trainers and the perspective of the pre-service teachers. This study investigates the benefits and challenges of using educational research findings for teacher trainers and pre-service teacher plus their motivational and attitudinal requisites. Overall n = 73 teacher trainers took part in the first part of the study. Results show that teacher trainers struggle with the time needed for evidence-based practice and the abundance of publications in educational research. In addition, the respondents stated using scientific findings to expand their own knowledge and to bring pre-service teachers to the current state of research. The long-term aim of the present study is to develop a learning environment that promotes scientific reasoning skills to be able to apply educational research findings to teaching practices.

### **III-8 Student Critique in Science Discourse: a multi-leveled analysis of one classroom discussion** Emily Reigh

Scientific argumentation is an interactive, social practice in which groups of scientists negotiate claims to generate knowledge (Latour & Woolgar, 1986; Longino, 2012). Studies have shown that children construct meaning through interaction with others (Alexander, 2005) and that engaging in constructive, critical dialogue supports learning gains (Chi, 2009; Mercer, 2013). At the whole class level, teacher-mediated discussion using evidence-based argument is a key tool of dialogic pedagogy that can help students to generate shared understandings of scientific phenomena. Critique plays a central role in scientific argument and is an explicit focus of the Next Generation Science Standards. However, critique is difficult for students to enact and is rare in classrooms (Henderson et al., 2015). In this paper, we present a revelatory case study of one science discussion in an elementary classroom that was rated highly using an instrument to evaluate the quality of classroom discourse (Osborne et al., 2016). A multi-leveled analysis of discourse was conducted using Studicode employing a combination of grounded and theoretically-driven approaches. Drawing on a detailed analysis of these data, we argue for a broad characterization of critique and its possible forms. Further, we explore the construct of epistemic progress (Golding, 2012), which characterizes advancement in a discussion in terms of collaborative negotiation of meaning, and consider the linguistic and structural forms of critique that enable such progress. We highlight potential social issues that can arise when students engage in critique and make recommendations for teachers to develop a constructive culture of critique in the classroom.

### **III-9 Biology Instruction under the View of a Generic Framework of Scientific Reasoning and**

### **Argumentation**

Tobias Dorfner, Christian Förtsch, Michael Germ and Birgit Jana Neuhaus

Poor results of German students in scientific literacy led to the introduction of German National Education Standards (NES) for science subjects (e.g. biology) in 2005. But, it is still not clarified, how to foster students' learning within scientific inquiry, a subdimension of the NES for biology (Kampa & Köller, 2016). One crucial element of scientific inquiry is scientific reasoning (Zimmerman, 2005). Fischer et al. (2014) developed a generic framework of scientific reasoning and argumentation (SRA) with eight epistemic activities (EPA). Our main goals were to show how often the EPA are used in biology instruction and how their use effects students' achievement. This study is part of the cooperative BMBF-funded project ProwiN. In the biological part of this project, two lessons from each teacher (N = 43 teachers) within the topic neurobiology in the 9th grade of German secondary schools (Gymnasium) were videotaped (N = 85 videos). We analyzed all videotaped lessons according to the occurrence of each EPA and calculated multi-level analyses for the effect of using more EPA on students' achievement (N = 788 students). We identified backlog demands using several EPA and showed a positive effect of using more EPA on students' achievement ( $\beta = .30$ ,  $SE = .15$ ,  $p < .05$ ). Inspired by these results, we planned three biology lessons in different grades and on different topics by explicitly considering all EPA. In conclusion, the framework of SRA seems to be a worthwhile methodical tool for teaching biology and promoting students' learning.

### **III-10 Development of Control of Variables Strategy abilities in preschool children**

April Christine Moeller and Beate Sodian

Children's abilities to control variables have been investigated as one component of scientific reasoning. However, there is limited research on preschool children's abilities in Control of Variables Strategy (CVS) tasks. Further, many CVS tasks are influenced by prior knowledge and may be too complex for children aged four to six. The present study aims to develop a context-free CVS task. In this novel task, children are shown confounded evidence, a stick of three differently colored legos makes a box light up, and then provided with three more sticks. They must pick one to place on the box in order to find out if a particular lego lights up. One choice, the correct one, controls two of the original colors and varies the color in question. The other choices vary two or three colors. Preliminary results show that young preschool children (n = 23, M = 57 months) did not differentiate between the choices. Older preschool children (n = 18, M = 72 months) showed a choice tendency toward the correct CVS choice. A majority of adults (control group, n = 14, M = 27.3 years) chose correctly and those who did not realized their mistake independently and then chose correctly. These preliminary results suggest our CVS task appears to be appropriate for investigating the development of CVS in young children and may indicate a beginning competence at CVS in preschool age.

### **III-11 Family Reunification: Professional Judgement construction and decision making process in social intervention with children at risk**

Marta Mascarenhas

The present research aims to study decisional models, underlying criteria and determining factors (objective and subjective) of professional judgement in risk situations, as well as the procedural logic behind professional's decision making in the Child and Youth Protection System, particularly Social Workers.

Emphasis will be given to criteria and arguments associated with the decision of child reunification, i.e., process through which a child protection professional determines conditions have been gathered for a child previously subjected to a severe danger situation (that caused her institutionalization) to be reunited with her family. In face of the invoked arguments, we will argue that families are not assessed based on purely rational criteria to determine their change potential and subsequent investment (or not) in child reunification, and shall aim to uncover this decision process's main features and determinants.

The main research goals to be achieved are: to compile and analyze the main arguments mobilized by professionals in different stages of child protection process (arguments typology); to explore risk conception and risk assessment models underneath such arguments in order to reach the intervention referential in this area; to assess the existence (or not) of different levels of technical autonomy according to the context in which child protection takes place (administrative or judicial); to understand the influence in the decision making process of factors that determine the "nondeliberative judgement" (Webb, 2012), considering less studied aspects such as intuition, emotion, professional instinct, as well as the use of tacit knowledge and practice wisdom arising from professional experience.

### **III-12 Measuring and fostering learners' research competencies: test construction and intervention**

Louise Maddens, Jan Elen, Fien Depaepe and Annelies Raes

According to the Flemish curriculum documents, pupils in secondary education need to acquire research competencies. Introducing students into this competency area is not only important for stimulating a well-considered study choice in higher education, but is also indispensable in the social context of the 21st century. Unfortunately, research has shown repeatedly that developing these competencies is far from evident (Fischer et al., 2014). There is a need for a more thorough understanding of how the development of research competencies can be supported. To meet this research challenge, this study aims to develop a test instrument to assess learners' research competencies. A set of parallel pre- and posttests is designed to measure four skills related to research competencies, namely orientation, preparation, implementation and reporting (De Groof et al., 2012). These instruments will be validated in the coming months (first through cognitive interviews with recently graduated secondary school students, then by testing the instrument on a larger scale with secondary school students in behavioral sciences). By March, we should be able to present the results from our test validation. In addition, this project elaborates and validates a number of theoretical principles on the design of technology-enhanced learning environments to support the development of research competencies with secondary school students and students in second chance education, and to investigate the role of task-oriented peer-conversations in this context. A quasi-experimental intervention study will be set up around April. The specific design of this intervention study needs to be further refined in the coming months.

### **III-13 Title: Advancement of economic competence – reasoning and argumentation within student-to-student interactions**

Christin Siegfried

Meanwhile economic competence is seen as a core component of general education systems (Dubs, 2011; Kaminski, 2001). Thus, most German states' school curricula take the development of economic competence into account. Despite that, studies report that young adults show a severe lack of economic competence (e.g. Hoidn & Kaminski, 2006).

Referring to a constructivist's understanding of learning (Piaget, 1989) the communication of individuals with its environment (other learners) is crucial for the co-construction of knowledge. Different perspectives and approaches can be addressed and connected to existing prior/previous acquired knowledge or caused cognitive conflicts (Piaget, 1989), stimulating critical reviews and revision of one's own knowledge (Cazden, 1988). Hence, potential effects of the related verbalization exist for the verbalizing person itself (Dörner, 1976) organising and structuring their own explanations or argumentation and for its classmates supporting an intellectually higher level of interaction (Forman, 1989). Therefore, particularly group discussions including explanations and argumentations are seen as profitable for learning outcomes (Chinn, O'Donell & Jinks, 2000).

Therefore, in the present study student-to-student interactions are investigated in the context of problem-based teaching in economics, since it might force students' cognitive activation. The overall teaching process of ten classes over 90 minutes is videotaped and analysed regarding the following objectives:

1. Coding reasoning and argumentation in student-to-student interaction reliable by developing a finely structured coding system.
2. Analysing the effect of the quality of reasoning and argumentation on learning outcomes in problem-based learning environments with focus on economics.