

**SURVEY ON “ASSISTANCE OF STUDENTS WITH MATHEMATICAL LEARNING
DIFFICULTIES – HOW CAN RESEARCH SUPPORT PRACTICE?”**

ICME SURVEY TEAM

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The planned survey will concentrate on the following aspects and questions:

1 Definitions of ›learning difficulties in mathematics‹ and ›mathematical learning difficulties‹ in different countries

The terms ›learning difficulties‹ and ›learning disabilities‹ and their use in different countries and different contexts (e.g., inclusive education) will be clarified to explore questions such as how these definitions influence ideology, theoretical approaches and policies, their impact on the research in this field and their influence on the development and use of diagnostic criteria and instruments (e.g., Mazzocco et al. 2008; Zang et al. 2008). Different definition models and the limitations of specific models (e.g., IQ-discrepancy) will be presented in detail (e.g., Fletcher et al. 2007; Francis et al. 2005). The crucial question of how the definitions of learning disabilities can be linked with agendas around inclusive education and inclusive schooling will be discussed. The ways in which students with mathematical difficulties or disabilities are described will be a focus (e.g., Andersson 2010; DeBlois 2014; Gersten et al. 2005; Moser Opitz 2013) addressed through consideration of questions such as: What are predictors for mathematical disabilities? What are specific mathematical topics the students show poor competencies in?

2 Professional teacher knowledge for assistance of students with LD

The role of teachers' beliefs about and expectations of students who underperform in mathematics will be taken into account as well as the role of teachers' professional knowledge. Various theoretical frameworks describing the knowledge needed to teach mathematics (e.g., content knowledge and pedagogical content knowledge; e.g., Hill et al. 2005), and didactical theories may be used. Interpretative models for specialized teachers or teachers' professionalization with respect to inclusive settings will also be discussed (e.g., DeBlois 2003; Heinrich et al. 2013). Relevant questions include: What is the nature of appropriate professional development activities for supporting teaching based on an understanding of the diversity of learning strategies and trajectories exhibited by students? What kinds of instruments and interventions enable all students to engage in conceptual learning of mathematics?

3 What do we know about effective teaching practices in (inclusive) mathematics classrooms? – intervention studies

This aspect deals with the different research fields of mathematics education and special education and resulting requirements and problems for research that arise. It will take into account the different conditions in this respect in different countries. Findings in relation to teaching mathematics; for instance »evidence-based remediation programs« will be presented as well as design-based research (Ise et al. 2012; Maccini et al. 2007). Successful intervention programs focussed on the development of conceptual understanding will be described (e.g., Freesemann 2014; Clements et al. 2013) and important factors such as the duration and intensity of the intervention will be analysed as well as important mathematical topics such as problem solving and basic competencies.

4 Concepts of assistance

Based on the preceding discussions this part will focus on concrete examples showing students' practices and behaviour when interacting with mathematics and considering pupils' behaviour in mathematics learning settings will be considered along with the conditions associated with different kinds of involvement with mathematics (conditions which appear to increase self-esteem, autonomy and motivation and as well as those which seem to elicit anxiety, agitation, avoidance or refusal of mathematical tasks). This theme will cover questions such as; How are students' participation and activity shaped by the kind of mathematics they encounter and the strategies adopted by their teachers (e.g., Ainscow 2013; Häsel-Weide et al. 2013; Gersten et al. 2009; Scherer 2014; DeBlois, 2015; Allen et al. 2011; Scherer/Moser Opitz 2010)? How do approaches emphasising explicit instruction compare with more open approaches?

All four aspects will be discussed from an international as well as national perspective. The team will review international research results as well as national features and developments. Concerning the activities of ICMEs, the period from ICME-10 in 2004 will be included.

References

- Ainscow, M. (2013). Developing More Equitable Education Systems: Reflections on a Three-year Improvement Initiative. In V. Farnsworth & Y. Solomon (Eds.): *Reframing Educational Research* (pp. 77-89). London: Routledge.
- Allen, J. P., Pianta, R.C., Gregory, A., Mikami, A.Y., Lun, J. (2011). An Interaction- Based Approach to Enhancing Secondary School Instruction and Student Achievement. *Science* 19, 333 (6045). 1034-1037.
- Andersson, U. (2010). Skill development in different components of arithmetic and basic cognitive functions: Findings from a 3-year longitudinal study of children with different types of learning disabilities. *Journal of Educational Psychology*, 102(1), 115–134.
- Clements, D. H., Sarama, J., Wolfe, C.B. & Spitler, M.E. (2013). Longitudinal evaluation of a scale-up model for teaching mathematics with trajectories and technologies: persistence of effects in the third year, 50(4), 812-850.
- DeBlois, L. (2015). La résolution de problèmes vues par les élèves qui manifestent des réactions d'évitement, d'anxiété ou d'agitation. *Vivre le primaire*.
- DeBlois, L. (2014). Le rapport aux savoirs pour établir des relations entre troubles de comportements et difficultés d'apprentissage en mathématiques. Dans *Le rapport aux savoirs: Une clé pour analyser les épistémologies enseignantes et les pratiques de la classe*. Coordonné par Marie-Claude Bernard, Annie Savard, Chantale Beaucher. En ligne: http://lel.crires.ulaval.ca/public/le_rapport_aux_savoirs.pdf
- Fletcher, J. M., Reid Lyon, G., Fuchs, L. S., & Barnes, M. A. (2007). *Learning disabilities. From identification to intervention*. New York: Guilford Press.
- Francis, D., Fletcher, J. M., Stuebing, K. K., Lyon, R. G., Shaywitz, B. A., & Shaywith, S. E. (2005). Psychometric approaches to the identification of LD: IQ and achievement scores are not sufficient. *Journal of Learning Disabilities*, 38(2), 98–108.
- Freeseemann, O. (2014). *Schwache Rechnerinnen und Rechner fördern: Eine Interventionsstudie an Haupt-, Gesamt- und Förderschulen*. Wiesbaden: Springer Spektrum.
- Gersten, R., Jordan, N. C., & Flojo, J. R. (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities*, 38(4), 293–304.
- Gersten, R., Chard, D. J., Jayanthi, M., Baker, S. K., Morphy, O., & Flojo, J. (2009). Mathematics instruction for students with learning disabilities: A meta-analysis of instructional components. *Review of Educational Research*, 79(3), 1202-1242.
- Häsel-Weide, U., Nührenbörger, M., Moser Opitz, E., Wittich, C. (2013). *Ablösung vom zählenden Rechnen. Fördereinheiten für heterogene Lerngruppen*. Seelze: Kallmeyer.

- Ise, E., Dolle, K., Pixner, S. & Schulte-Körne, G. (2012). Effektive Förderung rechenschwacher Kinder: Eine Metaanalyse. *Kindheit und Entwicklung*, 21(3), 181-192.
- Maccini, P., Mulcahy, C. A., & Wilson, M. G. (2007). A follow-up of mathematics interventions for secondary students with learning disabilities. *Learning Disabilities Research & Practice*, 22(1), 58-74.
- Mazzocco, M. M., Devlin, K. T., & McKenney, S. J. (2008). Is it a fact? Timed arithmetic performance of children with mathematical learning disabilities (MLD) varies as a function of how MLD is defined. *Developmental Neuropsychology*, 33(3), 318-344.
- Moser Opitz, E. (2013). *Rechenschwäche – Dyskalkulie: Theoretische Klärungen und empirische Studien an betroffenen Schülerinnen und Schülern* (2nd ed.). Bern: Haupt.
- Scherer, P. (2014). Low Achievers' Understanding of Place Value – Materials, Representations and Consequences for Instruction. In T. Wassong, D. Frischmeier, P. R. Fischer, R. Hochmuth & P. Bender (Eds.), *Mit Werkzeugen Mathematik und Stochastik lernen – Using Tools for Learning Mathematics and Statistics* (pp. 43-56). Wiesbaden: Springer.
- Scherer, P. & Moser Opitz, E. (2010). *Fördern im Mathematikunterricht der Primarstufe*. Heidelberg: Springer.
- Zang, X.Y., DeBlois, L., Kamanzi, C., & Deniger, MA. (2008) A Theory of Success for Disadvantaged Children: Re-conceptualisation of Social Capital in the Light of Resilience. *Alberta Journal of Educational Research* 54(1).97-112.