

## European Data Watch

This section offers descriptions as well as discussions of data sources that are of interest to social scientists engaged in empirical research or teaching courses that include empirical investigations performed by students. The purpose is to describe the information in the data source, to give examples of questions tackled with the data and to tell how to access the data for research and teaching. We focus on data from German speaking countries that allow international comparative research. While most of the data are at the micro level (individuals, households, or firms), more aggregate data and meta data (for regions, industries, or nations) are included as well. Suggestions for data sources to be described in future columns (or comments on past columns) should be send to: Joachim Wagner, Leuphana University of Lueneburg, Institute of Economics, Campus 4.210, 21332 Lueneburg, Germany, or e-mailed to <wagner@leuphana.de>. Past “European Data Watch” articles can be downloaded free of charge from the homepage of the German Council for Social and Economic Data (RatSWD) at: <http://www.ratswd.de>.

## **PISA, PIRLS, and more – The Research Data Centre at the Institute for Educational Progress (FDZ-IQB)**

By Michel Knigge, Imke Groeneveld, Petra Stanat,  
and Hans Anand Pant

### **1. Introduction: Large Scale Assessments in Educational Research**

Systematic Large Scale Assessment (LSA) Studies of cognitive competencies are a well established field in educational research. The results of LSA studies make it possible to monitor educational outcomes and thus support further development of educational systems and the organizations involved (Trautwein, 2009). The practice of educational assessment reaches back to the middle of the last century (Baumert/Stanat, 2006; Stanat/Lüdtkke, 2007). Already in the 50s the Pilot Twelve-Country Study (Foshay et al, 1962) was conducted to prepare the grounds for a more international scope in educational

assessment. In 1964 this resulted in the First International Mathematics Study (FIMS, Husén, T., 1967) and finally led to the institutionalization of the International Association for the Evaluation of Educational Achievement (IEA) in 1967 (IEA, 1993). Until today the IEA conducts LSA studies for comparisons across national borders. Best known is probably the Progress in International Reading Literacy Study (PIRLS, Mullis et al., 2007). Another important institution that also conducts international assessment studies is the Organization for Economic Co-Operation and Development (OECD, 1999) which organizes the well known Programme for International Student Assessment (PISA, OECD, 2007). In summary, there is a professional culture to conduct LSA studies on an international level.

Germany has a rather young history in conducting LSA studies. But the last two decades mark a tremendous growth in the field of educational assessment, thus Stanat and Doeber (2009, p. 4) conclude: “In terms of some developments, Germany lags behind, yet the process of catching up with these developments is currently well under way”. This “process of catching up” started when Germany resumed participation in international LSA studies in the 1990s of the last century with two studies of the IEA. First, in 1990/91 the Reading Literacy Study (Elley, 1993) showed that German 9- and 14-year-old students only had average results in reading comprehension compared with 30 other countries. In 1995 the Third International Mathematics and Science Study (TIMSS; Baumert et al., 1997) revealed similar results for seventh and eighth-graders with regard to their mathematical skills, although the competencies in science were somehow better. Surprisingly, these results were not recognized broadly by the public. In spite of this lack of interest, the participation of Germany in the Reading Literacy Study and TIMSS is referred to as *the empirical turning point*, marking the beginning of a new policy in educational monitoring.

Since the first German report of the Program for International Student Assessment (PISA) (Baumert et al., 2001) was published and again revealed only average competence levels for German students there is an enormous public interest in such data. The “PISA-shock” led to a broad reception of LSAS in general and accelerated their further development in Germany. While in the 1990s no more than five such studies have been conducted – since 2000 there have been about 50 German educational LSA investigations with regional, national, and international scope. The foundation of the Institute for Educational Progress (German abbreviation: IQB) in 2004 marked a stepping stone in this development. With the IQB a new central agency was established that is responsible to develop and conduct national LSAS on the basis of the German educational standards (Köller, 2008). These standards have been defined by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (German abbreviation: KMK). Thus, the IQB is the federal agency for the educational monitoring system in Germany at the national level.

## **2. Research Data Centre (FDZ) at the Institute for Educational Progress (IQB)**

From the very beginning after the empirical turning point there was a growing demand by the scientific community to get access to German educational LSA data for re-analyses. At the same time, the Commission for the Improvement of the Informational Infrastructure between Research and Statistics (2001; German abbreviation: KVI) suggested to support the installation of research data centres to support the further use of official and publicly funded statistical data for research purposes. In line with these demands, the IQB together with the Federal Ministry of Education and Research (German abbreviation: BMBF) and the KMK prepared the grounds for the foundation of the Research Data Centre (German abbreviation: FDZ) at IQB. Since 2007 the FDZ at IQB is in charge of support data use of German educational LSA data. It allows regulated access for non-commercial scientific purposes to educational LSA data in Germany. The initial funding until September 2011 was and continues to be provided by the BMBF. An independent evaluation commission of the German Data Forum (German abbreviation: RatSWD) suggested the extension of funding in 2009, and the KMK will fund the FDZ at the IQB from October 2011 onwards.

The “Tasks and Regulations of the Research Data Centre” (IQB, 2010) lay out a framework of rules when data should be made available and how to gain access. All German school-related data including measures of competencies should be made available to the FDZ-IQB within three years. However, exceptions may be applied for (e.g. in the case of doctoral dissertations) to extend exclusive access to data for an extra 9 months. This possibility was given to enhance the willingness to submit data as early as possible. In exceptional cases, this time period can be extended up to three years. For the sake of transparency, any kind of exclusive scientific rights are published on the website of the FDZ at IQB. This reference includes the name of the project, the name of the researcher in charge, and the period of time. This declaration is carried out concurrent with the publication of the data on the website of the FDZ at IQB. If such an indication is not given data can be used for any research questions that are in line with the Tasks and Regulations of the Research Data Centre (IQB, 2010). At the moment there are no such data access restrictions.

Due to the federal nature of Germany all applications that intend new comparisons between Länder have to be approved by the KMK. The KMK has not to be involved if similar comparisons were already published or if no explicit identification of single Länder is possible.

### **3. Application Procedure and Data Sets available at FDZ-IQB**

In line with the criteria of the German Data Forum (RatSWD, 2008) the FDZ at IQB grants data access for clearly defined scientific projects that have no commercial purposes. Data are free of charge and access can be granted to scientists all over the world. To apply, scientists have to submit a project proposal online ([www.iqb.hu-berlin.de/arbbereiche/fdz/antrag](http://www.iqb.hu-berlin.de/arbbereiche/fdz/antrag)). Here applicants have to indicate their name, institution, and position. Furthermore, a proposal of the research project needs to be given, stating which data are needed and what hypotheses will be tested. In most cases, contracts between the FDZ at IQB and the researchers will be prepared within four weeks and will be sent via email. The data user has to print, subscribe, stamp and mail two hardcopies of the contract. Access to the data can be granted as soon as both contracting parties have signed.

Data access can be provided in three ways: First, a data set can be obtained as a Scientific Use File (SUF). In the SUFs some variables are removed or recoded for data protection reasons. Second, if the SUF is not sufficient for the analysis, scientists have the possibility to use more comprehensive data sets with a web based service for remote execution. Remote execution makes it possible to conduct analysis without having direct access to the data. Users send in their command files which can be proofed in case that they might violate any data protection issues or other criteria. Only the output of the analysis will be sent back to the data user. The FDZ at IQB offers this service through a system called Job Submission application (JoSua; Askitas, 2008) that is provided for several institutions by the International Data Service Centre (IDSC) at the Institute for the Study of Labour (German abbreviation: IZA) in Bonn. Third, data users have the option for guest computing in protected working environments at FDZ at IQB or the IDSC at IZA. Due to the German data protection laws, SUFs are only available in countries of the European Community and affiliated states. For scientists in all other countries data access can be granted via JoSua or guest computing.

At present (January 2011), nine data sets are available for scientific access at the FDZ at IQB. These include the German data sets of PISA 2000 (Baumert et al., 2001), 2003 (Prenzel et al., 2005), and 2006 (Prenzel et al., 2007). PISA refers to secondary education with fifteen-year-olds as target population. Data are also available for the population of ninth graders. The competencies measured are reading, mathematics and science, with changing focus from cycle to cycle. The data also include psychological and social background variables and in some cases measures for cognitive ability. Additionally, teacher and school data can be used for reanalysis. All available data sets are cross sectional. The longitudinal extension – PISA 2003 plus – are not yet available at the FDZ at IQB but we expect these data to be made accessible by the consortium soon.

According to the Tasks and Regulations of the Research Data Centre (IQB, 2010) the data of PISA 2009 should be available by 2012.

The German data of PIRLS 2001 (German abbreviation: IGLU; Bos et al., 2003) and PIRLS/IGLU 2006 (Bos et al., 2008) are also available for scientific access at the FDZ at IQB. PIRLS/IGLU refers to elementary education with the fourth graders as the main population. The competencies measured are reading, mathematics and science. Also available are cognitive ability measures, teacher and school data. The data also include psychological and social background variables. All available data are cross sectional. There are no longitudinal extensions.

In addition to these international studies, data from German national and regional studies are also available at the FDZ-IQB. Cross sectional datasets are MARKUS (Helmke/Jäger, 2002) and QuaSUM (Lehmann et al., 1999). Both studies focus on mathematics and assessed psychological and social background data. Additional data on cognitive competencies are also available. MARKUS investigated the population of the eighth grade in the state of Rhineland-Palatinate. In QuaSUM, fifth and ninth graders in the state of Brandenburg were tested. DESI (Beck/Klieme, 2007), a study on English and German competencies of German students in Germany, but also in some regions of other European countries, will be available soon.

As a longitudinal dataset the ELEMENT-study (Lehmann/Lenkeit, 2008) is available at FDZ at IQB. It refers to grade 4 to grade 6 in Berlin with one measurement point per year. Competency data are available for German and mathematics. English was tested to some extent as well. Indicators of the psychological and social background and cognitive competencies and data from a questionnaire for the parents are also available. The FDZ at IQB prepared a documentation of the ELEMENT-study that is available in German and English.

Of course the FDZ at IQB grants access to the data produced at the IQB itself as well. According to the Tasks and Regulations of the Research Data Centre (IQB, 2010), the data of the recently published report on the language proficiency of the German Länder comparison (Koeller/Knigge/Tesch, 2010) will be available 2012 for secondary analyses.

#### **4. Training Services and Quality Assurance at FDZ-IQB**

To support the scientific use of data sets the FDZ at IQB offers information and training on the data. To enhance the capacities of current and potential data users to work with the complex data sets of LSA studies, the FDZ at IQB regularly carries out training seminars. Two different formats are available: First workshops on one specific study (e.g. use of PISA 2006 data) and sec-

ond workshops that focus on the methodology of LSA studies more generally (e.g. applying longitudinal models or dealing with missing data). To cover a large range of methodological issues, the FDZ recently has carried out week-long trainings with different foci each day. In these trainings, various statistical software packages are used, ranging from SPSS (SPSS Inc., 2007), and Stata (StataCorp, 2009) to R (R Development Core Team, 2009), Conquest (Wu et al., 2007) and Mplus (Muthén/Muthén, 2007). The topics covered are also broad in scope and include structural equation modelling, hierarchical linear models, logistic regressions, and propensity score matching. All trainings are evaluated by the participants and the feedback is used to improve the choice and arrangement of upcoming seminars.

A variety of quality assurance measures are applied to monitor the outcomes of the work at FDZ at IQB. As already mentioned, the evaluation by an independent commission revealed good results in 2009. Annual reports are made to the BMBF and from 2011 on to the German Data Forum. The user contracts oblige researchers to provide copies of articles and books based on the data made available by the FDZ at IQB. Surveys are conducted to complete the documentation of secondary scientific analyses done with the provided data. Despite its short history, evidence suggests that the FDZ at IQB has become an important institution in the landscape of educational research in Germany, facilitating the use of LSA data and enhancing the output of educational research.

## References

- Askitas, N.* (2008): Data Documentation and Remote Computing at the International Data Service Center of IZA, IASSIST Quarterly.
- Baumert, J./Lehmann, R./Lehrke, M./Schmitz, B./Clausen, M./Hosenfeld, I./Köller, O./Neubrand, J.* (1997): TIMSS. Mathematisch-Naturwissenschaftlicher Unterricht im internationalen Vergleich. Deskriptive Befunde, Max-Planck-Institut für Bildungsforschung, Berlin.
- Baumert, J./Stanat, P.* (2006): Internationale Schulleistungsvergleiche, in: D. H. Rost (Hrsg.), Handwörterbuch Pädagogische Psychologie (3. Aufl.), Weinheim, 291–302.
- Beck, B./Klieme, E.* (Hrsg.) (2007): Sprachliche Kompetenzen. Konzepte und Messung. DESI-Ergebnisse Band 1, Weinheim.
- Bos, W./Lankes, E.-M./Prenzel, M./Schwippert, K./Walther, G./Valtin, R.* (Hrsg.) (2003): Erste Ergebnisse aus IGLU – Schülerleistungen am Ende der vierten Jahrgangsstufe im internationalen Vergleich, Münster.
- Bos, W./Hornberg, S./Arnold, K.-H./Faust, G./Fried, L./Lankes, E.-M. et al.* (Hrsg.) (2008): IGLU-E 2006. Die Länder der Bundesrepublik Deutschland im nationalen und internationalen Vergleich, Münster.
- Commission for the Improvement of the Informational Infrastructure between Research and Statistics* (2001): Towards a better informational infrastructure, Baden-Baden.

- Elley, W. B. (1993): The IEA Reading Literacy Study. The International Report, Oxford.
- Foshay, A. W./Thorndike, R. L./Hotyat, F./Pidgion, D. A./Walker, D. A. (1962): Educational Achievement of Thirteen-Year-Olds in Twelve Countries, Hamburg, UNESCO Institute for Education.
- Helmke, A./Jäger, R. S. (Hrsg.) (2002): Das Projekt MARKUS. Mathematik-Gesamterhebung Rheinland-Pfalz: Kompetenzen, Unterrichtsmerkmale, Schulkontext, Landau.
- Husén, T. (Ed.) (1967): A Comparison of Twelve Countries: International Study of Achievement in Mathematics, Stockholm.
- IEA Guidebook (1993): Activities, institutions and people.
- IQB (2010): Aufgaben und Verfahrensweise des Forschungsdatenzentrums (FDZ) (Stand: Mai 2010) [Tasks and Regulations of the Research Data Centre (State: May 2010)], retrieved on October 1, 2010 from [http://www.iqb.hu-berlin.de/arbberiche/fdz/dateien/FDZ\\_V1.pdf](http://www.iqb.hu-berlin.de/arbberiche/fdz/dateien/FDZ_V1.pdf).
- Köller, O. (2008): Bildungsstandards - Verfahren und Kriterien bei der Entwicklung von Messinstrumenten, Zeitschrift für Pädagogik 54, 167–173.
- Köller, O./Knigge, M./Tesch, B. (2010): Sprachliche Kompetenzen im Ländervergleich. Münster.
- Lehmann, R./Lenkeit, J. (2008): Element. Erhebung zum Lese- und Mathematikverständnis. Entwicklung in den Jahrgangsstufen 4 bis 6 in Berlin: Abschlussbericht über die Untersuchungen 2003, 2004 und 2005 an Berliner Grundschulen und grundständigen Gymnasien. Berlin, Humboldt-Universität zu Berlin.
- Lehmann, R./Peek, R./Gänsfuß, R./Lutkat, S./Mücke, S./Barth, I. (1999): QuaSUM. Qualitätsuntersuchung an Schulen zum Unterricht in Mathematik. Ergebnisse einer repräsentativen Untersuchung im Land Brandenburg. (Reihe Schulforschung in Brandenburg, Heft 1), Potsdam, Ministerium für Bildung, Jugend und Sport im Land Brandenburg.
- Mullis, I. V. S./Martin, M. O./Kennedy, A. M./Foy P. (2007): PIRLS 2006 International Report: IEA's Progress in International Reading Literacy Study in Primary School on 40 countries. Chestnut Hill, MA.
- Muthén, L. K./Muthén, B. O. (2007): Mplus User's Guide. Fifth Edition. Los Angeles.
- Organisation for Economic Co-Operation and Development (OECD) (1999): Measuring student knowledge and skills. A new framework for assessment, Paris, OECD.
- Organisation for Economic Co-operation and Development (OECD) (2007): PISA 2006: Science competencies for tomorrow's world, Paris, OECD.
- Prenzel, M./Artelt, C./Baumert, J./Blum, W./Hammann, M./Klieme, E./Pekrun, R. (Hrsg.) (2007): PISA 2006: die Ergebnisse der dritten internationalen Vergleichsstudie, Münster.
- Prenzel, M./Baumert, J./Blum, W./Lehmann, R./Leutner, D./Neubrand, M./Pekrun, R./Rost, J./Schiefele, U. (Hrsg.) (2005): PISA 2000: der zweite Vergleich der Länder in Deutschland – was wissen und können Jugendliche? Münster.

- Rat für Sozial- und Wirtschaftsdaten* (2008): Kriterien des Rates für Sozial- und Wirtschaftsdaten (RatSWD) für die Forschungsdaten-Infrastruktur. Berlin: RatSWD, retrieved on December 12, 2008 from [http://www.ratswd.de/download/publikationen\\_rat/RatSWD\\_FDZKriterien.PDF](http://www.ratswd.de/download/publikationen_rat/RatSWD_FDZKriterien.PDF).
- Stanat, P./Doebert, H. (2009): Data in the Domain of School Education – Secondary School: Present situation, New Developments, and Future Requirements, RatSWD Working Paper Series, Working Paper No. 70.
- Stanat, P./Lüdtke, O. (2007): Internationale Schulleistungsvergleiche, in: G. Trommsdorff/H.-J. Kornadt (Hrsg.): Enzyklopädie der Psychologie: Kulturvergleichende Psychologie, Band 3: Kulturelle Determinanten des Erlebens und Verhaltens, Göttingen, 279–347.
- SPSS Inc. (2007): SPSS Base 16.0 User's Guide. Chicago, IL: SPSS Inc.
- StataCorp. (2009): Stata Statistical Software: Release 11. College Station, TX: StataCorp LP.
- Trautwein, U. (2009): Measuring Cognitive Competencies. RatSWD Working Paper Series, Working Paper No. 126.
- Wu, M. L./Adams, R. J./Wilson, M. R./Haldane, S. (2007): ConQuest (Version 2.0), Camberwell, Australia, ACER.