9 Increasing Heterogeneity in Students' Prior Economic Content Knowledge – Impact on and Implications for Teaching in Higher Education

Roland Happ, Olga Zlatkin-Troitschanskaia, Klaus Beck, and Manuel Förster

9.1 Heterogeneous Cognitive Preconditions – a Challenge for Teaching in Higher Education

Studies have revealed increasing heterogeneity among students entering higher education (see Morgan 2012; Zwick 2012; for business and economics studies in Germany see Happ & Zlatkin-Troitschanskaia 2014). In the European Higher Education Area, this phenomenon is attributed, in part, to the structural changes following the Bologna reform (see Bologna Declaration 1999). In general, these changes are attracting a higher age group to tertiary education and are resulting in more heterogeneous student bodies (see Adelman 2009; Association of American Colleges and Universities 2007; Leicht-Scholten, Breuer, Tulodetzki & Wolffram 2011). In the United States, similar trends can be seen in degree courses in economics (for prior knowledge of economics of first-year students in the U.S., see CEE 2014).[1]

Research on secondary (see e.g., Peske & Haycock 2006) and tertiary education has shown that heterogeneous classes are challenging for the teaching (e.g., for differences in prior knowledge of economics at the beginning of higher education, see Brückner, Förster, Zlatkin-Troitschanskaia & Walstad 2015; Zlatkin-Troitschanskaia, Förster, Schmidt, Brückner & Beck 2015). Heterogeneity is found not only in the social and cultural backgrounds of first-year students in economic studies (for approaches considering the personal background in teaching see, e.g., Bartlett 2012), but also in cognitive preconditions, such as prior knowledge of economics (see CEE 2014), and in general intellectual ability (see Prins, Veenman & Elshout 2006). In fact, such differences in personal dispositions often manifest during secondary school (e.g., for PISA, see Fertig 2003; for TIMMS, see Mullis et al. 2000). These differences are perpetuated in the achievements of the students as recorded over the course of their secondary school education and consequently during their

1 For a theory-based discussion on reasons for and implications of the increasing heterogeneity of student bodies in business and economic studies in higher education institutions, see Happ & Zlatkin-Troitschanskaia (2015).

transition to higher education (e.g., Becker & Hecken 2009). In light of this, in some studies the influence of personality characteristics on study outcomes has been reviewed (see Parker 2006). However, to date, no longitudinal analysis has been conducted of how post-secondary students' attributes influence their acquisition of ECK. In this study, we report results from an assessment of ECK over the course of studies in higher education. The evidence can be used to guide the development of suitable didactic and curricular approaches for teaching heterogeneous groups in higher education. Understanding how personality characteristics influence knowledge acquisition is necessary to ensure that increasingly heterogeneous groups of students have an equal chance to succeed in business and economic studies.

To develop adequate measures for teaching in higher education institutions (see section 5), it is essential to know in what ways and to what extent students in the same degree course differ in cognitive preconditions. These preconditions include prior knowledge, which is an indicator for students' acquisition of content knowledge. In the very popular field of business and economics, teachers are confronted with the challenging task of assessing students' prior knowledge in order to tailor teaching methods to meet their students' needs (see Exeter, Ameratunga, Ratima, Morton, Dickson, Hsu & Jackson 2010). Therefore, these teachers need objective data allowing them to decide rationally on teaching-learning arrangements.

To study the influence of personal characteristics on the acquisition of ECK over time, we conducted a longitudinal study measuring knowledge gains while controlling for heterogeneity criteria within the student population.[2] To determine the most important factors of heterogeneity, we followed suggestions from teaching and learning theory and focused on the prior knowledge of learners (see e.g., Brückner, Förster, Zlatkin-Troitschanskaia & Walstad 2015) and on their general intellectual ability (Prins, Veenman & Elshout 2006).[3] We investigated the extent to which these two characteristics affect knowledge acquisition in economics. In addition, we explored whether heterogeneous groups of students with diverse personal characteristics acquire the same level of ECK over the course of their studies in economics.

In section 2, we describe the assessment design and test instrument employed to measure individual states of economic knowledge. In section 3.1, we discuss the analyzed cognitive indicators of heterogeneity. In section 3.2, we present our results based on longitudinal multilevel modeling. We conclude with a critical discussion of our findings and propose some ideas on methods for teaching economics to heterogeneous groups of students.

2 For further information on the theoretical basis of the research project, see Zlatkin-Troitschanskaia et al. (2013) and Happ (in prep.).

3 The reasons for focusing on these two personal characteristics are also discussed in Happ (in prep.), Happ & Zlatkin-Troitschanskaia (2014), and Zlatkin-Troitschanskaia et al. (2013).

9.2 Assessment Design and Test Instrument

Over four dates between 2008 and 2011 we assessed 3,625[4] students from business and economics degree courses. We gathered information on their prior knowledge and intelligence, as well as their performance on an ECK test as indicators of heterogeneity. At the beginning of the winter terms of 2008/09, 2009/10, 2010/11, and 2011/12, students taking basic courses in economics were given a paper–pencil test which took approximately 45 minutes to complete. As part of the survey, students generated a personal code to remain anonymous but, nonetheless, clearly identifiable across several measuring dates (see section 4, also Happ in prep.).

We administered the German adaptation (WBT)[5] (Beck, Krumm & Dubs 2001) of the American Test of Economic Literacy (TEL) developed by Soper and Walstad (1987) to obtain an objective, reliable, and valid measurement of the participants' ECK (see Zlatkin-Troitschanskaia, Förster & Kuhn 2013). In business and economic studies in Germany, economic content (along with parts of statistics and mathematics) comprises a large part of the curriculum (for a curricular analysis of degree courses in Germany (N = 98) and for an online survey of lecturers (N = 78), see Zlatkin-Troitschanskaia, Förster, Brückner & Happ 2014). Thus, the assessment design follows the curriculum–instruction–assessment triangle (see Pellegrino 2010)[6]. The test had been validated comprehensively for higher education in Germany. Validation analyses included content and construct validation (see Förster, Happ & Zlatkin-Troitschanskaia 2012), as well as analyses of prognostic validity (see Beck & Wuttke 2004; Brückner, Happ & Schmidt 2013).

4 This is the total number of observations from 2,615 students. There were 104 observations of students who participated four times, 561 observations of students who participated three times, 1,116 observations of students who participated twice, and 1,844 observations of students who participated once. This unbalanced longitudinal sample required the use of an appropriate method for the statistical analyses, such as longitudinal multilevel modeling (see section 3.2; see Hox 2010; 2011). For a distribution of personal variables, such as gender and age, see Happ (in prep.).

5 The adaptation of this test enables not only national analysis, but also systematic international comparisons (Walstad & Watts 2010; Walstad 1994). The TEL and its adaptations already have been used in many countries, including the U.S., Canada and Australia (MacDonald & Rebeck 2007), Austria, Germany, Great Britain, Korea, Switzerland (Lüdecke & Sczesny 1999), and Japan (Yamaoka, Asano & Abe 2007). The literature includes numerous international comparisons (for comparative studies see, e.g., Yamaoka, Walstad, Watts, Asano & Abe 2010).

6 For use of the triangle model in an intervention study in which economic content knowledge of students in Rhineland-Palatinate was assessed (see Kuhn et al. 2014: 151).

The TEL comprises two versions: A and B. Each version consists of 46 test items including 15 joint anchor items.[7] The items are in multiple-choice format, start with a short description of a situational context, and are followed by four response options, one of which is correct (Asarta & Rebeck 2012). For the English and German tests, measurement properties and quality criteria based on classical test theory have been well researched and validated (Beck, Krumm & Dubs 2001; Soper & Walstad 1987). A varying difficulty of items on the TEL and on the WBT enables differentiation within an adequate range of ability levels from low to high.

The data for this study were gathered using an abridged version of the WBT. The same items were administered at all four assessment dates. From test versions A and B, the 19 items that showed the highest curricular validity were selected. We considered the item selection adequate for assessing student knowledge of economic fundamentals over the course of their studies (see Happ in prep.).

In addition to investigating performance, we gathered socio-demographic data including person-related control variables, such as gender and age. We expected students' prior ECK to vary considerably depending on their previous learning experiences during secondary education. In most federal states in Germany, general education schools do not offer economics as a separate subject. Rather, economic contents and concepts are taught only occasionally and unsystematically in other subjects, such as social studies and geography.

In Germany, 86 percent of higher education students come from general education schools (Federal Statistical Office 2014). Alternatively, students can gain entrance qualifications to higher education from vocational schools or from specialized upper secondary schools, focusing, for example, on business and economics. Only in these types of school business and economic content is taught as an individual subject, allowing programmatic and systematic acquisition of ECK. Thus, students who have completed commercial vocational training (i.e., an apprenticeship) can be expected to have at least rudimentary knowledge of business and economics at their disposal (Kuhn 2014: 233–234). Equally, students having attended a commercial upper secondary school where business and economics are major subjects also should have acquired knowledge of economics. Having this in mind (see Erdel 2010), we operationalized prior ECK by two indicators: either participants had completed a commercial vocational training program or they had attended a course specifically in business and economics at school.

7 The selection of TEL items used in the assessment was verified against the curricula of the participating institutions of higher education. The analysis showed that the selected items were valid with regard to the curriculum of business and economic studies in higher education in Germany.

General student intellectual ability was assessed using two indicators: final school grade[8] and verbal intelligence. Though there is some criticism on the use of the final school grade as an indicator (see Brückner, Happ & Schmidt 2013; Uthmann 2009), in the international studies conducted by Bridgeman, McCamley-Jenkins and Ervin (2000) and in those by Kobrin, Patterson, Shaw, Mattern and Barbuti (2008) students' final school grade correlated with their intellectual ability. This also is true in respect to verbal intelligence as measured by the 20-item scale Verbal Analogies from the German Intelligence Structure Test (IST, "Intellingenz-Struktur-Test 2000R", Liepmann, Beauducel, Brocke & Amthauer 2007), which allows a sum score that is highly correlated with general intelligence to be computed.[9]

9.3 Prior Domain-Specific Knowledge and Acquisition of ECK

9.3.1 Distribution of cognitive indicators among students

In this section, we provide a descriptive analysis of the distribution of the two indicators of heterogeneity in the sample. The following measurement results indicate central tendencies of the respective measurement distributions and illustrate the degree of heterogeneity among the students surveyed. We measured students' prior ECK in terms of the economics-related learning opportunities they had before starting their post-secondary studies, and we gathered data on students' general intellectual ability as indicated by their final school grades and their performance on a verbal intelligence scale.

Our findings reflected the typical diversity of pre-university education in Germany. Of our students, 20.5% had completed a commercial apprenticeship before entering university and 27.7% had taken business and economics as a major subject at school. This result indicates that more than half of the first-year students entered tertiary education without any systematic knowledge of business and economics.

Grade values ranging from 1.0 (best grade) to 4.0 (lowest passing grade) showed a standard deviation of 0.5 in final school grades, with the median being 2.3. Half of the students surveyed achieved a final grade ranging from

8 In Germany, the final school grade upon graduation from upper secondary school serves as an entrance qualification for studies in higher education institutions.

9 In this study, we also used the Number Series scale to assess numerical intelligence. However, we soon observed ceiling effects and excluded the items on number series from further assessment. This is why data on numerical intelligence is not available for all measuring dates, and why we did not include it in the longitudinal analysis.

2.0 to 2.7; 25% of the students achieved a grade better (i.e. lower) than 2.0, while another 25% achieved a grade worse (i.e. higher) than 2.7. These results signify a substantial variance in final school grades and, thus, a heterogeneous distribution among the students.

A similar picture emerged regarding the distribution of verbal intelligence based on the IST verbal analogy sub-scores. The median was 11 of the 20 points. Scores showed a standard deviation of 3.2 points. Half of the students scored between 9 and 13 points; one-quarter scored fewer than 9 points; and one-quarter scored more than 13 points. Again, these results indicated a heterogeneous distribution of general intelligence among the students. Overall, we found a heterogeneous distribution of prior ECK and general intellectual ability among the students of our sample.

9.3.2 Effects of Prior ECK and General Intellectual Ability on the Acquisition of ECK over the Course of Studies

To analyze the effects of prior ECK and general intellectual ability on the acquisition of ECK, we used multilevel models of change measurement (see Hox 2011; Raudenbush & Bryk 2002).[10] We used confirmatory factor analysis (Kline 2005; Byrne 2012) in Mplus (Muthén & Muthén 1998–2014) to analyze the dimensionality of the 19 items from the WBT based on the assessment data gathered at each of the four assessment dates. The analyses of the 19 items showed a one-dimensional structure:

Table 1: Confirmatory factor analyses for the four assessment dates

	t_1	t_2	t_3	t_4
Estimator	WLSMV	WLSMV	WLSMV	WLSMV
N	789	699	1,097	1,040
χ2/df	1.42	1.52	1.55	1.77
χ2	215,591	231,723	235,854	269,645
Df	152	152	152	152
RMSEA	0.023	0.027	0.022	0.027
TLI	0.937	0.816	0.947	0.900

Surprisingly, we did not find two separate dimensions, one for microeconomics and one for macroeconomics (Hansen 2001; OECD 2011; Zlatkin-Troitschanskaia et. al 2014). All items showed a significant positive loading on the latent factor. This can be explained, in part, by the use of an abridged

10 For a discussion on methodology regarding the advantages of multilevel modeling over, for example structural equation modeling based on latent growth curves (see Chou, Bentler & Pentz 1998).

version of WBT/TEL. Furthermore, some general principles of economics, such as the scarcity principle, apply to a broad range of economic issues, including fundamentals of economics as well as microeconomics and macroeconomics. Therefore, we calculated the following multilevel models based on only one total score of ECK.

Regarding the multilevel analyses, we had various options to measure time. In our study, we could have made use of the age of the students, the four assessment dates t_1–t_4, or the number of the students' completed semesters of study. Singer and Willett (2003) suggest using a data exploration procedure with several measures of time in order to determine the best one. In the end, we based modeling on the number of completed semesters of study as a measure of time because the exploratory data analysis clearly indicated that this measure would provide the best results (see Happ in prep.). This made sense because a higher number of completed semesters of study also would indicate a higher number of completed courses in economics.

We analyzed the data using longitudinal multilevel modeling. The serial observations over the four assessment dates (level 1) were nested in the students (level 2). It was reasonable to assume that the level of ECK would vary less over time for the same participant than it would among participants. Such dependence can be represented through multilevel modeling. But to justify the use of the multilevel approach, we first needed to confirm that we could predict enough of the variance on all levels through meaningful predictors (see e.g., Singer & Willett 2003).

In the beginning of our analyses, we calculated a random intercept only (RIO) model (Snijders & Bosker 1999) by running the command "xtmixed" on STATA (Rabe-Hesketh & Skrondal 2012: 249). In this RIO model, the intra-class correlation coefficient (ICC) amounted to 0.32, which means that 32% of the whole variance was caused by the students being in different semesters. Taking into account that the number of economic courses attended had not yet been controlled, this was a substantial part of the variance (on the calculation method, see Luke 2004). To represent the non-linear development of ECK over the course of studies in the multilevel models, we progressively included a linear, quadratic, and cubic term for time (see Goldstein 2011). In addition, we evaluated whether or not each term significantly improved the model. In doing so, we considered Hox' recommendation (2010: 33) telling us that, if in doubt, a preference should be given to simpler, lower-order models rather than higher-order models. In all models, the linear term for time was positive and affected especially the initial semesters. We found a larger increase in ECK at the beginning of a student's studies and stagnation

from the sixth semester onwards.[11] The decrease we identified was due to the significant negative quadratic term for time. From the perspective of teaching and learning, the shape of this declining part of the development curve (see Figure 1) can be interpreted as an indication of the effects of forgetting (e.g., Baddeley, Eysenck & Anderson 2010). In later semesters, the decrease in the level of ECK resulting from the negative quadratic term for time was compensated for by the positive and also significant cubic term.

Next, we analyzed the extent to which personal cognitive attributes affected the acquisition of ECK over the course of studies. The two factors of prior ECK and general intellectual ability proved to have a substantial influence on the level of ECK. In the cubic model, all four indicators had a significant influence on acquisition of ECK. The results of the calculations are shown in Table 2.

Gill and Gratton-Lavoie (2011) reported similar results for the United States, where completing a course in economics at high school also had a positive effect on the level of ECK.

It is worth noting that all these calculations refer to the intercept term, that is, the differences apply only to the initial levels of ECK (Hox 2010). This also implies that the differences in initial knowledge levels are not compensated (substantially) for over the course of studies. The multilevel analysis showed variance only in the intercepts, not in the slope factors. This means students varied only in their initial level of knowledge, not in their knowledge acquisition rate (see Happ in prep.). Figure 1 shows a plot of the acquisition of ECK among the students surveyed along the course of their studies.[12] Depending on prior ECK and general intellectual ability, the curve of ECK may start from a higher or lower level. The final knowledge level is determined exclusively by the intercept term and not by the slope factors, which did not contribute to the explained variance.

11 It might be possible that we assessed a selection of low-performing higher-semester students because we did not expect those students to attend the courses. The sample included students with up to 18 semesters of study. We also calculated these models for a sample excluding students who had completed more than 12 semesters, but this did not lead to any substantial changes in the results. This means that considerably fewer students in higher semesters did not introduce any element of bias to the parameter estimations.

12 Regarding the development curve, we used the test instrument to assess fundamental knowledge in economics (see section 3) in higher education only. This test instrument does not assess specialized economic content from advanced levels of study. Nevertheless, the fundamentals assessed are also relevant for higher semesters of study since they form the basis for more specialized content (see Happ in prep.).

Table 2: Acquisition of ECK based on a cubic multilevel model

Fixed Effect	
Intercept	9.461521***
Slope number of semesters (linear)	1.035718***
Slope number of semesters (quadratic)	- 0.1238821***
Slope number of semesters (cubic)	0.0044762***
t_2	0.7248816**
t_3	0.1639293
t_4[13]	- 0.300272**
Commercial vocational training (completed)	0.5566519***
Course in business and economics as major school subject (taken)	0.5611557***
Final school grade (centered)	0.5279176***
Analogy score (centered)[14]	0.322575***
Random Effect	
Residual variance level 2	2.822618
Residual variance level 1	4.613816
Model Quality	
Deviance	17,943.54
AIC	17,969.54
BIC	18,050.50

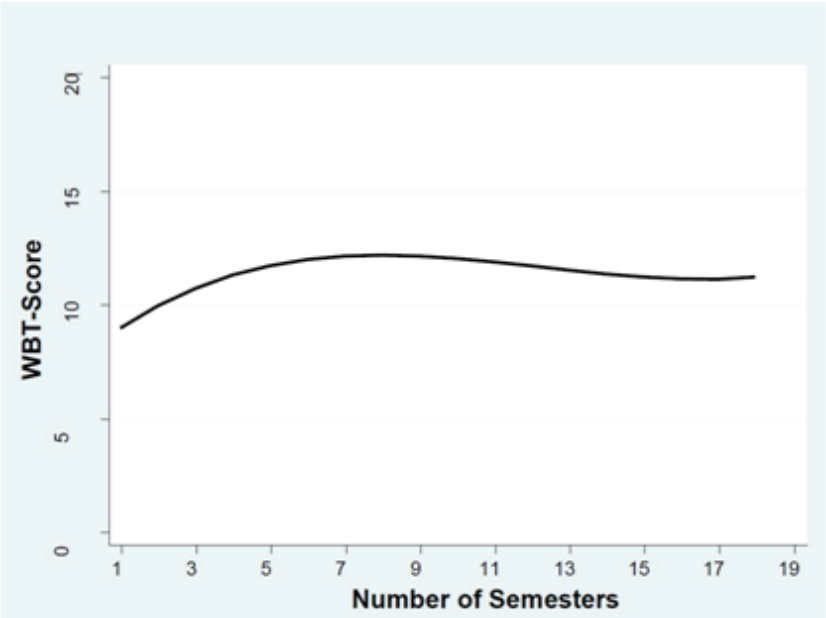
*** significance level p < 0.001 (two-sided);** significance level p < 0.05 (two-sided);* significance level p < 0.1 (two-sided)

The results clearly show that the differences in the acquisition of ECK, which result from heterogeneous personal cognitive attributes of students, were not compensated for through learning opportunities in higher education over the course of their studies (using the number of economic courses completed as an indicator for learning opportunity).

13 This study was conducted over four assessment dates. At each, there might have been different experimental conditions of test taking. To control for effects of different assessment conditions in the longitudinal analysis, we included the dates as dichotomous variables in the models.

14 Final school grade and analogy score were centered on the median for easier interpretation. This means the coefficients in the multilevel model are indicated in relation to a final school grade of 2.3 and an analogy score of 11.

Figure 1: Development of ECK



9.4 Implications for Teaching Economics in Higher Education

Our analyses clearly confirmed the supposition that students of business and economics differ significantly in their prior ECK and their general intellectual ability.[15] The initial data of our study revealed substantial heterogeneity among the first-year students. As long as it is a generally accepted expectation of higher education instructors to compensate for these differences by interventions via tuition in the sense of mastery learning (for the origins of mastery learning, see Carroll 1963; Motamedi & Sumrall 2000; Jensen 2006), teaching economics in higher education will remain an enormous challenge. The situation is very similar in the United States, where colleges have to cope

15 In this paper, we do not discuss international comparisons of differences in prior economic content knowledge among students, but rather refer to other studies such as the international comparison between Germany and the United States based on the Test of Understanding in College Economics (TUCE; Walstad, Watts & Rebeck 2007) reported by Brückner, Förster, Zlatkin-Troitschanskaia & Walstad (2015).

with rapidly increasing numbers of students enrolling in economics courses (see Siegfried 2012: 724). With regard to the sample of students in Germany, our analyses showed that acquisition of ECK over the course of their studies was strongly influenced by their personal cognitive preconditions.

The findings from longitudinal modeling highlight the crucial importance of formative performance assessments (see Dolan & Burling 2012) at least in business and economics in higher education. In other words, process diagnostics at a degree course level and at an individual level are urgently needed. For teachers in higher education, it would be a major advantage to have access to information on students' preconditions, made available through systematic assessment and analysis at the beginning and over the course of their studies. This information could enable teachers in higher education to address the needs of their students in an informed and adequate way when designing curricula, preparing learning opportunities, selecting content and methods, and delivering courses. Moreover, having accurate information on their students' preconditions, teachers could be encouraged to develop new, innovative forms of teaching, learning, and assessing, which in turn would help them manage in a competent and fair way their heterogeneous classes. Today, numerous methodological approaches and didactic suggestions are geared to the needs of small groups of learners (e.g., on using cooperative learning exercises in economics, see Hoyt & McGoldrick 2012). It is not our aim to criticize these approaches; rather we strongly propose that – in times of Massive Open Online Courses (MOOCs; see Perna, Ruby, Boruch, Wang, Scull, Ahmad & Evans 2014) – learner-centered approaches should also be developed for large-scale courses.

In the case of economics[16], a teaching method that deserves mentioning is Simkins's (2012) "Just-in-Time Teaching" (JiTT). In JiTT, learners are given a few short exercises and are asked to submit their responses prior to class. The teacher evaluates the responses and, by doing so, he or she can better prepare the next class by adapting it to the needs of the given learners. A key advantage of this method is that the teacher can prepare the class to address major misconceptions the students may have (see Bransford, Brown & Cocking 2000). As a result, teachers are able to tailor their teaching approach to the current state of knowledge of their students. In addition, this might encourage students to reflect metacognitively on their personal learning processes (see Simkins 2012: 111). For larger courses, it is possible to use JiTT with online exercises in a multiple-choice format combined with an online tool that provides the teacher with information on the students' current state of knowledge, a strategy which functions as a kind of formative assessment. This also could encourage students to engage with the subject matter outside of class (see Simkins 2012: 110). At the same time it could help

16 For a more detailed review of learning methods in economics, see Hoyt & McGoldrick (2012).

teachers estimating the extent to which students understand the subject matter.

McDermott (1991: 303) points out that there is a considerable difference between a teacher's expectations of what students should know and what students actually know at the beginning of course. To help teachers understand their students better, JiTT might offer a measure to detect knowledge gaps among students before course begins. Of course, JiTT is only one of many methods to improve academic teaching in large-scale courses. However, common to all of them is that teachers are in need of valid information not only on the prior knowledge and learning skills of their students but also on the progress of knowledge and skills acquisition they stimulate through their teaching.

Another possibility would be to offer preparation courses for students before they begin to study at university. This might ensure that the prior ECK of a group of students is more homogenous at the beginning of degree courses. Preparation courses, such as those in mathematics, often are offered in higher education. In economics, no core curriculum or standards for general secondary education exists. ECK is taught unsystematically, making it a challenge for universities to define economic principles and determine prerequisite knowledge for university students. As long as this situation continues, preparation courses could serve to eliminate some of the heterogeneity in prior ECK among students at the beginning of higher education.

References

Adelman, Clifford (2009): The Bologna Process for U. S. eyes: Re-learning higher education in the age of convergence. Washington, DC: Institute for Higher Education Policy.

Asarta, Carlos/Rebeck, Kenneth (2012): Measurement techniques of student performance and literacy: college and high school. In: Hoyt, Gail M./McGoldrick, KimMarie (eds.): International handbook on teaching and learning economics. Northampton (Massachusetts): Edward Elgar Publishing, pp. 307-318.

Association of American Colleges and Universities (2007): College learning for the new global century. Washington, DC: Association of American Colleges and Universities.

Baddeley, Alan/Eysenck, Michael W./Anderson, Michael C. (2010): Memory. Hove u. a.: Psychology Press.

Bartlett, Robin L. (2012): Integration race, gender and class. In: Hoyt, Gail M./McGoldrick, KimMarie (eds.): International handbook on teaching and learning economics. Cheltenham: Edward Elgar Publishing, pp. 213-222.

Beck, Klaus/Wuttke, Eveline (2004): Eingangsbedingungen von Studienanfängern – Die prognostische Validität wirtschaftskundlichen Wissens für das Vordiplom bei Studierenden der Wirtschaftswissenschaften [Higher education students' entry conditions – prognostic validity of school knowledge in business and eco-

nomics for undergraduate students' success in business and economic studies.]. In: Zeitschrift für Berufs- und Wirtschaftspädagogik [Journal of Vocational Studies and Business and Economic Education], 2004, 100(1), pp. 116-124.

Beck, Klaus/Krumm, Volker/Dubs, Rolf (2001): WBT – Wirtschaftskundlicher Bildungstest [German adaptation of the Test of Economic Literacy (TEL)]. In: Sarge, Werner/Wottawa, Heinrich (eds.): Handbuch wirtschaftspsychologischer Testverfahren [Handbook of testing methods in business psychology]. Lengerich: Pabst, pp. 559-562.

Becker, Rolf/Hecken, Anna E. (2009): Why are working-class children diverted from universities? – an empirical assessment of the diversion thesis. In: European Sociological Review, 2009, 25(2), pp. 233-250.

Bologna-Declaration (1999): The Bologna-process. Retrieved from http://www.aic.lv/ace/ace_disk/Bologna/index.htm on 12 December 2014.

Bransford, John D./Brown, Ann L./Cocking, Rodney R. (2000): How people learn: Brain, mind, experience, and school: expanded edition. Washington, DC: National Academica Press.

Bridgeman, Brent/McCamley-Jenkins, Laura/Ervin, Nancy (2000): Predictions of freshman grade-point average from the revised and recentered SAT I: Reasoning Test (College Board Report No. 2000-1). New York: College Entrance Examination Board.

Brückner, Sebastian/Happ, Roland/Schmidt, Susanne (2013): Validitätsproblematik bei der Prognose des Studienerfolgs mittels standardisierter Testverfahren in der Studiendomäne Wirtschaftswissenschaften [Validity of tests for student assessment in the domain of business and economics in higher education]. In: Zlatkin-Troitschanskaia, Olga/Nickolaus, Reinhold/Beck, Klaus (2013): Kompetenzmodellierung und Kompetenzmessung bei Studierenden der Wirtschaftswissenschaften und der Ingenieurwissenschaften [Modeling competencies of students in business and economics and engineering]. Lehrerbildung auf dem Prüfstand (Special Issue). Landau: Verlag Empirische Pädagogik (in German), pp. 7-25.

Brückner, Sebastian/, Förster, Manuel/ Zlatkin-Troitschanskaia, Olga/ Walstad, William B. (2015): Effects of prior economic education, native language, and gender on economic knowledge of first-year students in higher education. A comparative study between Germany and the USA. Studies in Higher Education, 2015, 40(3), pp. 437-453.

Byrne, Barbara (2012): Structural equation modeling with Mplus. Basic concepts, applications and programming. New York & London: Routledge.

Carroll, John B. (1963): A model of school learning. In: Teachers College Record, 1963, 64, pp. 723-733.

Chou, Chih-Ping/Bentler, Peter M./Pentz, Mary A. (1998): Comparisons of two statistical approaches to study growth curves: The multilevel model and the latent curve analysis. In: Structural Equation Modeling, 1998, 5(3), pp. 247-266.

Council for Economic Education (CEE) (2014). Survey of the states. Economic and personal finance education in our nation's schools 2014. Retrieved December 12, 2014, from http://www.councilforeconed.org/wp/wp-content/uploads/ 2014/ 02/ 2014-Survey-of-the-States.pdf.

Dolan, Robert P./Burling, Kelly S. (2012): Computer-based testing in higher education. In: Secolsky, Charles/Denison, D. Brian (eds.): Handbook on measurement,

assessment, and evaluation in higher education. New York & London: Routledge, pp. 321-335.
Erdel, B. (2010). Welche Determinanten beeinflussen den Studienerfolg? : eine empirische Analyse zum Studienerfolg der ersten Kohorte der Bachelorstudenten in der Assessmentphase am Fachbereich Wirtschaftswissenschaften der Friedrich-Alexander-Universität Erlangen-Nürnberg. [Which determinants influence academic success? An empirical analysis of the academic success of the first cohort of bachelor students in the assessment phase (first year of studies) at the School of Business and Economics of Friedrich Alexander University of Erlangen-Nuremberg] Nuremberg: Chair for sociology and empirical social research (report). Retrieved from http://nbn-resolving.de/urn:nbn:de:0168-ssoar-220222
Exeter, Daniel J./Ameratunga, Shanthi/Ratima, Matiu/Morton, Susan/Dickson, Martin/Hsu, Dennis/Jackson, Rod (2010): Student engagement in very large classes: The teachers' perspective. In: Studies in Higher Education, 2010, 35(7), pp. 761-775.
Federal Statistical Office (2014): Schulen auf einen Blick. [Schools at a glance.] Wiesbaden: Federal Statistical Office (in German).
Fertig, Michael (2003): Who's to blame? The determinants of german students' achievement in the PISA 2000 Study, IZA Discussion Paper 739. Bonn: Institute for the Study of Labor.
Förster, Manuel/Happ, Roland/Zlatkin-Troitschanskaia, Olga (2012): Valide Erfassung des volkswirtschaftlichen Fachwissens von Studierenden der Wirtschaftswissenschaften und der Wirtschaftspädagogik – eine Untersuchung der diagnostischen Eignung des Wirtschaftskundlichen Bildungstests (WBT). [Valid assessment of economic content knowledge among students of business and economics and business education – an examination of the diagnostic suitability of the Wirtschaftskundlicher Bildungstest (WBT).] In: Zeitschrift bwp@ Berufs- und Wirtschaftspädagogik – online [Journal bwp@ vocational and business education – online.], 2012, 22, pp. 1-21.
Gill, Andrew M./Gratton-Lavoie, Chiara (2011): Retention of high school economics knowledge and the effect of the California state mandate. In: The Journal of Economic Education, 2011, 42(4), pp. 319-337.
Goldstein, Harvey (2011): Multilevel statistical models (4th edition). London: Wiley.
Hansen, W. Lee (2001): Expected proficiencies for undergraduate economics majors. In: The Journal of Economic Education, 2001, 32(3), pp. 231-242.
Happ, Roland (in prep.): Die Entwicklung des volkswirtschaftlichen Grundlagenwissens im Studienverlauf – Effekte von Eingangsvoraussetzungen auf den Wissenserwerb [Development of Fundamental Economic Knowledge over the Course of Studies in Higher Education – Effects of Students' Entry Conditions on their Knowledge Acquisition]. Landau: Verlag Empirische Pädagogik [Empirical Education Publishing].
Happ, Roland/Zlatkin-Troitschanskaia, Olga (2014): Assessing the quality of the bachelor degree courses: An analysis of their effects on students' acquisition of economic content knowledge. In: Zeitschrift für Hochschulentwicklung [Journal for Higher Education Improvement], 2014, 9(2), pp. 64-77.
Happ, Roland./Zlatkin-Troitschanskaia, Olga (2015): Vergleichende Analysen zur Heterogenität der Studierenden in wirtschaftswissenschaftlichen Studiengängen – kritische Implikationen für die Qualitätsevaluation in Studium und Lehre. [Com-

parative analyses of heterogeneity among students in degree courses in business and economics– Critical implications for evaluation of quality of teaching and learning.] In: Susan Harris-Hümmert/ Lukas Mitterauer/ Philipp Pohlenz (eds.). Heterogenität der Studierendenschaft: Herausforderung für die Qualitätsentwicklung in Lehre und Studium, neuer Fokus für die Evaluation? [Heterogeneity of the student body: A challenge for improving the quality of teaching and learning, and a new focus for evaluations?] Bielefeld: Universitätsverlag Webler (in press).

Hox, Joop J. (2010): Multilevel analysis – Techniques and applications (2nd edition). New York: Routledge.

Hox, Joop J. (2011): Panel modeling: Random coefficients and covariance structures. In: Hox, Joop J./Roberts, J. Kyle (eds.): Handbook of advanced multilevel analysis. New York & London: Routledge, pp. 85-96.

Hoyt, Gail M./McGoldrick, KimMarie (2012): International handbook on teaching and learning economics. Cheltenham: Edward Elgar Publishing.

Jensen, Eric (2006): Enriching the brain: How to maximize every learner's potential. San Francisco, CA: Jossey-Bass.

Kline, Rex B. (2005): Principles and practice of structural equation modeling (3rd edition). New York: Guilford Press.

Kobrin, Jennifer L./Patterson, Brian F./Shaw, Emily J./Mattern, Krista D./Barbuti, Sandra M. (2008): Validity of the SAT for predicting first-year college grade point average (College Board Research Report No. 2008-5). New York: The College Board.

Kuhn, Christiane (2014): Fachdidaktisches Wissen von (angehenden) Lehrkräften im kaufmännisch-verwaltenden Bereich – Modellbasierte Testentwicklung und Validierung [Pedagogical content knowledge of (future) teachers in business and economics: Theoretical modeling, test development, and validation]. Landau: Verlag Empirische Pädagogik.

Kuhn, Christiane/ Happ, Roland/ Zlatkin-Troitschanskaia, Olga/ Beck, Klaus/ Förster, Manuel/ Preuße, Daja (2014): Kompetenzentwicklung angehender Lehrkräfte im kaufmännisch-verwaltenden Bereich – Erfassung und Zusammenhänge von Fachwissen und fachdidaktischem Wissen [Competence development of future teachers of business and economics: Assessment of and relationship between content knowledge and pedagogical content knowledge.] In: Winther, Esther/ Prenzel, Manfred (eds.), Perspektiven der empirischen Berufsbildungsforschung: Kompetenz und Professionalisierung [Perspectives from empirical educational research: competence and professionalization.] (p. 149-167). (Zeitschrift für Erziehungswissenschaft, 17 (1), Special Issue 22). Wiesbaden: Springer.

Leicht-Scholten, Carmen/Breuer, Elke/Tulodetzki, Nathalie/Wolffram, Andrea (2011): Going diverse: Innovative answers to future challenges. Gender and diversity perspectives in science, technology and business. Opladen: Budrich UniPress.

Liepmann, Detlev/Beauducel, André/Brocke, Burkhard/Amthauer, Rudolf (2007): Intelligenz-Struktur-Test 2000 R [Intelligence Structure Test 2000 R]. Göttingen: Hogrefe.

Lüdecke, Sigrid/Sczesny, Christoph (1999): Ökonomische Bildung im internationalen Vergleich. [An international comparison of economic education.]. In: Wirtschaft und Erziehung [Economy and Education], 1999, 51, pp. 130-139.

Luke, Douglas A. (2004): Multilevel modeling. Thousand Oaks, CA, London, New Delhi: Sage Publications.
McDermott, Lillian C. (1991): Millikan Lecture 1990: What we teach and what is learned – closing the gap. In: American Journal of Physics, 1991, 59(4), pp. 301-315.
MacDonald, Richard/Rebeck, Ken (2007): Performance on Form B of the TEL 3 at Two Minnesota Universities in USA. In Yamaoka, Michio/ Asano, Tadayoshi/ Abe, Shintaro/Rebeck, Ken (eds.): Comparative Studies on Economic Education in Asia-Pacific Region: Economic Literacy in High School and University. Tokyo: Kokusai-Bunken Publishing, pp. 1-8.
Morgan, Deanna L. (2012): College placement testing of entering students. In: Secolsky, Charles/Denison, D. Brian (eds.): Handbook on measurement, assessment, and evaluation in higher education. New York & London: Routledge, pp. 367-381.
Motamedi, Vahid/Sumrall, William J. (2000): Mastery learning and contemporary issues in education. In: Action in Teacher Education, 2000, 22(1), pp. 32-42.
Mullis, Ina V. S./Martin, Michael O./Gonzalez, Eugenio J./Gregory, Kelvin D./Garden, Robert A./O'Connor, Kathleen M./Chrostowski, Steven J./Smith, Teresa A. (2000): TIMSS 1999 international mathematics report: Findings from IEA's repeat of the third international mathematics and science study at the eighth grade. Chestnut Hill, MA: Boston College.
Muthén, Linda K./Muthén, Bengt O. (1998-2014): Mplus users's guide. Los Angele, CAs: Muthén & Muthén.
Parker, Kudayja (2006): The effect of students characteristics on achievement in introductory mircoreconomics in south africa. In: South African Journal of Economics, 2006, 74(1), pp. 137-149.
Pellegrino, James W. (2010): The design of an assessment system for the race to the top: A learning sciences perspective on issues of growth and measurement. Princeton: ETS.
Perna, Laura W./Ruby, Alan/Boruch, Robert F./Wang, Nicole/Scull, Janie/Ahmad, Seher/Evans, Chad (2014): Moving Through MOOCs: Understanding the Progression of Users in Massive Open Online Courses. In: Educational Researcher, 2014, 43(9), pp. 421-432
Peske, Heather G./Haycock, Kati (2006): Teaching inequality: How poor and minority students are shortchanged on teacher quality. Washington, DC: Education Trust.
Prins, Frans J./Veenman, Marcel V.J./Elshout, Jan J. (eds.): The impact of intellectual ability and metacognition on learning: New support for the thresholds of problematicity theory. In: Learning and Instruction, 2006, 16(4), pp. 374-387.
Rabe-Hesketh, Sophia/Skrondal, Anders (2012): Multilevel and longitudinal modeling using Stata (3rd edition). College Station, TX: Stata Press.
Raudenbush, Stephen W./Bryk, Anthony S. (2002): Hierarchical linear models. Thousand Oaks, CA: Sage.
OECD (2011): Tuning-AHELO Conceptual Framework of Expected and Desired Learning Outcomes in Economics. OECD Education Working Papers, No. 59. Retrieved from on 12 December 2014.
Siegfried, John J. (2012): The economics major in the United States. In: Hoyt, Gail M./McGoldrick, KimMarie (eds.): International handbook on teaching and learning economics. Cheltenham: Edward Elgar Publishing, pp. 723-732.

Simkins, Scott (2012): Using Just-in-Time Teaching to promote student learning in economics. In: Hoyt, Gail M./McGoldrick, KimMarie (eds.): International handbook on teaching and learning economics. Cheltenham: Edward Elgar Publishing, pp. 107-117.

Singer, Judith D./Willett, John B. (2003): Applied longitudinal data analysis. Modeling change and event occurrence. Oxford, New York: Oxford University Press.

Snijders, Tom A. B./Bosker, Roel J. (1999): Multilevel analysis: An introduction to basic and advanced multilevel modeling. London: Sage.

Soper, John C./Walstad, William B. (1987): Test of economic literacy. Examiner's manual. New York: Joint Council on Economic Education.

Uthmann, Claudia. (2009): Studierendenauswahl – Erprobung und Evaluation eines multidimensionalen testdiagnostischen Verfahrens zur Studienerfolgsprognose an der Fachhochschule Heidelberg. [Student selection – Testing and evaluating a multidimensional diagnostic test battery to predict study outcomes at the University of Applied Sciences Heidelberg.] Saarbrücken: Südwestdeutscher Verlag für Hochschulschriften.

Walstad, William B. (1994) (Ed.): An International Perspective on Economic Education. Boston: Kluwer.

Walstad, William B./Watts, Michael (2010): Economic education in an international context. In: Journal of Economic Education, 2010, 41(4), pp. 410-412.

Walstad, William B./Watts, Michael/Rebeck, Kenneth (2007): Test of understanding in college economics: Examiner's manual (4th edition). New York: National Council on Economic Education.

Yamaoka, Michio/Asano, Tadayoshi/Abe, Shintaro (2007): Economic literacy of Japanese high school and university students: An international comparison based on the TEL3. In: Yamaoka, Michio/Asano, Tadayoshi/Abe, Shintaro/Rebeck, Kenneth (eds.): Comparative studies on economic education in asia-pacific region: economic literacy in high school and university. Tokyo: Kokusai-Bunken Publishing, p. 51-79.

Yamaoka, Michio/Walstad, William B./Watts, Michael/Asano, Tadayoshi/Abe, Shintaro (2010): Comparative studies on economic education in Asia-Pacific region. Tokyo: Shumpusha Publishing.

Zlatkin-Troitschanskaia, Olga/Förster, Manuel/Kuhn, Christiane (2013): Modeling and Measurement of University Students' Subject-Specific Competencies in the Domain of Business & Economics – The ILLEV Project. In: Blömeke, Sigrid/Zlatkin-Troitschanskaia, Olga/Kuhn, Christiane/Fege, Judith (eds.): Modeling and measuring competencies in higher education. Rotterdam: Sense Publishers, pp. 159-170.

Zlatkin-Troitschanskaia, Olga/Förster, Manuel/Brückner, Sebastian/Happ, Roland (2014): Insights from a German assessment of business and economics competence. In: Coates, Hamish (eds.): Higher education learning outcomes assessment – International perspectives. Frankfurt/ Main: Peter Lang, pp. 175-197.

Zlatkin-Troitschanskaia, Olga/Förster, Manuel/Schmidt, Susanne/Brückner, Sebastian/Beck, Klaus (2015): Erwerb wirtschaftswissenschaftlicher Fachkompetenz im Studium – Eine mehrebenanalytische Betrachtung von hochschulischen und individuellen Einflussfaktoren. [Assessing students' professional competency in business and economics – a multi-level analysis of contextual and individual variables in Higher Education.]. In: Blömeke, Sigrid/Zlatkin-Troitschanskaia, Olga

(eds.): Kompetenzen von Studierenden [Student competencies.] [Special Issue]. Zeitschrift für Pädagogik [Journal of Education], 2015, 61. Beiheft [supplement], pp. 116-135.
Zwick, Rebecca (2012): Admission testing in higher education. In: Secolsky, Charles/ Denison, D. Brian (eds.): Handbook on measurement, assessment, and evaluation in higher education. New York & London: Routledge, pp. 382-404.