

Testing economic literacy: an overview of measurement instruments of the past 30 years

Nina Charlotte Johanna Welsandt^a, Hermann Josef Abs^a

^aUniversität Duisburg-Essen, Essen, Germany

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- Measurement instruments often represent only one domain at a time.
- The focus of test instruments is on querying declarative knowledge.
- Authentic assessments are rarely being used.

Purpose: This paper analyses and classifies currently available English- and German-language measurement instruments for assessing economic literacy. It shows the content-related focuses and gaps of the extracted test instruments, the cognitive level of demand that characterises the instruments, the technical forms of implementation, and the extent to which the lifeworld contexts of test participants were considered.

Method: The PSYNDEX, ERIC, German Education Index, and GESIS databases were systematically reviewed, and measurement instruments were examined based on four perspectives of analysis: economic subject dimension, learning psychology, assessment formats and technical design, and authenticity.

Findings: Knowledge tests differ substantially from each other. Rather than representing all domains of the subject of economics equally, test instruments usually measure only one domain at a time. The focus of test instruments is on the retrieval of declarative knowledge. Measurement instruments were developed for adults and young people in equal parts. While some test instruments are related to the real world, authentic assessments are an exception.

Corresponding author:

Nina Welsandt, Universität Duisburg-Essen, Fakultät für Bildungswissenschaften, Universitätsstr. 2 45141 Essen, Germany, E-Mail: nina.welsandt@uni-due.de

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1 INTRODUCTION

Measuring students' knowledge in economic literacy is more important and more relevant than ever as this knowledge is linked to a growing need to make substantiated financial decisions and to understand how these will affect the future (Haupt, 2022). Economic literacy is a prerequisite for acquiring economic autonomy and actively taking part in a developing society (Winther, 2010). Traditionally, economic literacy is equated with understanding, evaluating, and judging overall economic contexts (Soper & Walstadt, 1998). In this sense, economic literacy involves understanding written texts and tables with fundamental economic concepts in everyday contexts. The impact of complex economic processes on social life requires a basic level of economic literacy in order to comprehend and manage private and business situations. Education systems that aim for economic equality among learners should include economic literacy as an education component for all (Lo Prete, 2018, p. 200).

The past decade has seen a significant expansion of education for economic literacy in schools in Germany, a controversial development that has been described as a curriculum reform (Gökbudak, 2021; Kaminski, 2017). In the school year 2020/2021, the integrated subject of economics with politics (economics-politics) was made mandatory in all lower secondary schools in Germany's biggest federal state, North Rhine-Westphalia, to prepare young people for a self-determined life and a successful career in a globalised world (Ministerium für Schule und Bildung [MSB], 2021). The new subject is intended to enable pupils to participate actively and responsibly in the social, political, and economic shaping of society (MSB, 2021). In addition, the new subject aims to equip students with the knowledge required to achieve successful mastery of economic life situations (MSB, 2019a, p. 7). Economic literacy also supports the development of domain-specific competencies in trainees during vocational learning processes (Winther, 2010).

Digitalisation permeates society and has far-reaching effects on the education sector. Technologies affect work processes, leisure activities, and communication (Sangmeister et al., 2018, p. 66). Digitalisation and the continuing advance of the network society are leading to a change in the skills profile required by diverse population groups. For example, technological change ensures that financial operations are carried out more quickly. Social change is particularly evident in the service society as digital technologies are replacing more and more human activities. Increasingly complex tasks require a higher level of economic competencies. These technical and societal changes must be reflected in creating new measurement instruments for surveying economic competencies.

Measurement instruments for economic literacy have changed over the past decades. At the same time, the demands placed on the economic citizen have also changed (Scheffler, 2018). The test of economic literacy (TEL; Soper & Walstad, 1987) and its German adaptation (Beck & Krumm, 1998) are frequently used in national and international studies. However, the TEL has been criticised for focusing exclusively on aspects of knowledge and for reducing a broader concept of economic literacy to a

narrower concept of economics. Overarching economic contexts and economic policy decisions should be given more space (Ackermann, 2019, p. 48). Existing measurement instruments have been criticised for using a one-sided concept of economic literacy. One example is the OEKOMA measurement tool (Schumann & Eberle, 2014). While this tool includes content related to economics and business administration, its focus on economic concepts instead of economic problems is problematic. Furthermore, OEKOMA has been criticised for using multiple-choice rather than innovative answer formats (Ackermann, 2019, p.51). For example, technology-based survey methods are becoming increasingly popular. In addition to technical advantages, technology-based test instruments provide opportunities to capture areas of competence beyond purely cognitive knowledge content. Authentic test environments can be modelled by including multimedia content (Jude & Wirth, 2007, p. 49). Many measurement instruments have been developed to measure economic literacy. What constitutes a good or bad measurement instrument varies depending on the orientation and implementation of the study. When creating a measurement instrument, the target group and the research aim must be precisely formulated. When developing new test items, it is helpful to begin with an analysis of existing measurement instruments in the field and their respective content focus. Researchers of current studies on economic literacy face the question of which content-related orientations and methodological approaches to focus on when developing new measuring instruments. Measurement instruments published over the past three decades represent a resource that can be considered for adaptation for new research projects. For this purpose, researchers can profit from an overview of previously published measurement instruments and an analysis of their content and methodological approach.

A systematic review of German- and English-language instruments for measuring economic literacy does not yet exist. This paper contributes towards closing this research gap. It offers a systematic review of the German- and English-language measurement instruments for assessing economic literacy published in the past 30 years, with a view to determining their respective strengths and weaknesses and the differences and similarities between the tests. Analysis maps the current state of research on the assessment of economic literacy. First, the concept of economic literacy is explored from a theoretical perspective. Subsequently, the researched measurement instruments are analysed in detail. The measurement instruments are mapped according to whether they measure a subject-specific perspective or the learning psychology perspective, and according to criteria relating to their assessment format, their technical implementation, and authenticity. Finally, a comparative evaluation of the measurement instruments is conducted and their potential benefits and possibilities for improvement are presented.

2 THEORETICAL BACKGROUND: THE CONCEPT OF ECONOMIC LITERACY

In a broad sense, economic literacy designates an individual's competence to act efficiently and self-determinedly in economic life situations (Albers, 1995). The concept of literacy is based on a functional understanding of education; individuals should be able to take part in social life by developing their knowledge and skills (Winther, 2010). This section explains the meaning, delimitation, and pertinent levels of analysis of the concept of economic literacy as relevant for this article in more detail. A search for the term *economic literacy* on Google Scholar returned 3,680,000 results in only 0.03 seconds (as at 05 May 2023). The various definitions of economic literacy include many aspects which reflect a diverse understanding of economic education in research, including economic literacy, economic numeracy, general and civic economic education, financial literacy, financial numeracy, and consumer education. Terms are partly used synonymously with each other and partly to emphasise different aspects of content. It is important to examine each of these aspects of economic literacy as they reflect different understandings of economic education in research and can provide insights into the development of economic measurement instruments. For the purpose of this paper, *economic literacy* was taken to denote general economic education since the focus was the systematic analysis of existing measurement instruments in economic literacy. The aim was to determine which German- and English-language measurement instruments have been used over the past 30 years.

Economic literacy is conceptualised by Beck and Krumm as a three-dimensional concept: (1) economic knowledge and cognition, (2) attitude towards economics, and (3) economics-related moral reflectiveness. In this context, economic literacy is a prerequisite for responsible action. Economic attitudes affect the perception of situations. Economic moral reflectiveness includes norms and values in decision-making situations (Beck & Krumm, 1998, p. 581). The economic literacy test (Wirtschaftskundlicher Bildungstest [WBT], Beck & Krumm, 1998), a German adaptation of the TEL (Walstad et al., 2013), is considered a pioneering measurement instrument that has been used in numerous national and international studies. However, a systematic analysis of measurement instruments should consider how economic demands are being addressed cognitively. In line with the criticism levied against other instruments, the WBT also covers only part of the above definition, and it does not examine attitudes and moral reflections. It can thus be observed that existing tests for measuring economic literacy are generally based on a narrow understanding of competence.

Economic literacy can be differentiated into vocational and civic economic education (Dubs, 2011; Ackermann, 2019). The focus of vocational economic education lies in occupation-specific competencies. Civic economic education corresponds to general economic education. Both occupation-specific and general economic competencies are relevant for successfully coping with domain-specific requirements in commercial occupational fields (Winther et al., 2016). This shows that general economic literacy is relevant not only for successful learning processes in vocational training but also forms a

condition for successful participation in society. When analysing measurement instruments, it is interesting to pay attention to their actual content to determine where their focus lies, or if indeed there even is a specific focus.

In current discourse, general economic education is mapped using the concept of economic literacy, whereby economic literacy describes the competences required to participate socially in economic contexts. Economic literacy builds on the respective level of individuals' development of economic thinking and economic knowledge (Winther, 2010). In greater detail, economic literacy and economic numeracy can be described as areas of economic knowledge that are connected to specific economic subdomains and that represent the competences of economic (professional) action. Economic literacy and economic numeracy can be distinguished from each other as follows: economic literacy involves linguistic-argumentative knowledge and an understanding of basic economic concepts, whereas economic numeracy draws on the mathematical-analytical approach, i.e. the mastery of basic mathematical knowledge and skills (Winther, 2010, p. 54–55). Using related terminology, research refers to economic and business concepts (Retzmann et al., 2010; Seeber et al., 2012; Eberle et al., 2016), consumer education (Weber, 2014; Hedtke, 2005; MSB, 2019b), or financial literacy (Aprea et al., 2016). Further, the content of general economic education can be divided into fundamental economic concepts, microeconomic concepts, macroeconomic concepts, and international economic relations (Beck, 1998, p. 584; Saunders & Gilliard, 1995; Weber, 2017). These aspects of economic literacy as brought forth in the current discourse are also reflected in the dimensions of analysis elaborated below.

Another concept exists alongside that of economic literacy, namely the concept of financial literacy. Colloquially, financial literacy and economic literacy are often used synonymously. Nevertheless, the two concepts can be distinguished from each other (Greimel-Fuhrmann et al., 2021; Organisation for Economic Co-operation and Development [OECD], 2014). Financial literacy refers not only to a specific financial qualification but includes knowledge and a variety of skills, attitudes, and confidence that leads to reflective financial decision making (Lusardi & Mitchell, 2014; Cude, 2022, p. 5). The first definition of financial literacy dates back to 1990 (Cude, 2022, p. 5). Since then, it has been subject to considerable change, and there is now no longer one universally valid definition. Most recently, Nicolini (2022) has defined financial literacy as a multidimensional concept that, besides knowledge, includes the ability to apply learned skills and attitudes to financial decisions. It is important to note that financial literacy now encompasses many subcategories, such as financial knowledge, numeracy, and capability. Basic mathematical education is a condition for financial literacy (Lusardi, 2012; Darriet et al., 2022). While some researchers view financial literacy as an essential component of economic literacy (Weber, 2017), the OECD (2014) explicitly distinguishes between economic and financial literacy. Financial literacy focuses on the individual perspective; economic literacy centres around individuals' ability to comprehend their own circumstances and the broader economic context, enabling them to understand the

situations of others as well (Greimel-Fuhrmann et al., 2021; OECD, 2014). Concerning the analysis of existing measurement instruments, it can be assumed that some instruments are conceptualised around financial literacy while others focus more on overarching economic areas.

The next section presents the four dimensions of analysis which reflect the respective focuses of the individual measurement instruments that were examined: the economic subject dimension; the learning psychology dimension; the dimension of assessment format and technical design; and the dimension of authenticity. These dimensions, which will be described in detail below, were selected because they are of specific relevance when it comes to developing new assessment instruments for a broad range of age groups in a more digitalised context. Therefore, it is interesting to identify whether and how each dimension has evolved over time. The analysis will allow researchers to identify suitable assessment instruments in a more targeted way.

The first dimension of analysis investigated the subject of economics itself. Terminologically, economic literacy was defined here as a concept which queries content in the areas of business administration, economics (see Eberle, 2016), and consumer education (see MSB, 2019b). This first dimension of analysis forms the basis for a broad understanding of economic literacy. A wide range of economic topics covers individual and societal perspectives on economic contexts. The subdimension of economic content (Saunders, P., & Gilliard, J. V., 1995) includes the four fundamental content areas of economics, microeconomics, macroeconomics, and international economics. Within the economic content subdimension, individuals as citizens or residents of a country interact with economically influenced situations with a broader impact on society. The subdimension of consumer education (MSB, 2019b) is divided into three content areas: overarching area; finance, market activity, and consumer law; and living and housing and mobility. This content area concentrates on individual decisions in a person's private life, focusing on situations that are influenced by economics. Business administration (Weber, 2017) forms a further subdimension and comprises general and cross-occupational action situations. Additionally, we included the theme of sustainability, which cuts across all dimensions of economic literacy (Birindiba Batista et al., 2022). Sustainability refers to the principle of striving for a balance between the availability of natural resources and their use by society. Sustainability is frequently applied to the environment, society, and the economy, and is often associated with the normative model of sustainable development. Furthermore, sustainability can be conceptualised at the micro, meso, and macro level (Corsten & Roth, 2012). The micro level represents ecological and individual sustainability. Decisions at this level ensure the continued existence of the system. The meso level describes the entrepreneurial use of the system by organisations. The macro level maps social and societal sustainability, focusing on people (Pufé, 2017). Incorporating sustainability as a cross-cutting theme in economic education promotes a future-oriented mindset and behaviours that consider ecological, economic, and social aspects in equal measure. Integrating sustainability into economic education as an overarching political

concept fosters an understanding of the complex interrelationships between the economy and the environment and contributes to long-term sustainable development.

The second dimension of analysis focused on learning psychology, namely the level of cognitive complexity underlying the test instruments. In general, economic education is rarely an independent subject in schools. Instead, it is often integrated into social studies or citizenship education. For this reason, the analysis was based on a general perspective of learning psychology rather than focusing solely on subject-specific didactics. Marzano and Kendall, writing in the tradition of learning-goal taxonomies (Bloom et al., 1956), have presented a taxonomy that makes a more decisive distinction between the retrieval of declarative knowledge and the retrieval of procedural knowledge. Their taxonomy encompasses not only information-related dimensions of knowledge, but also mental processing and the action processes necessary for specific contextual demands. This taxonomy enables a more comprehensive description of the characteristics of learning and work situations, which is also beneficial for the analysis and development of items. Marzano and Kendall's taxonomy is a two-dimensional model. The first subdimension is the knowledge domain. The knowledge domain is divided into the information domain for the retrieval of declarative knowledge, and the domain of mental processes for the retrieval of procedural knowledge. Mental processes as the second subdimension, in turn, comprise three tiers. According to Marzano and Kendall, information is processed first by the self-system, then by the metacognitive system, and finally by the cognitive system. The self-system uses personal beliefs and goals to cope with new tasks. It is an interdependent system comprising attitudes, beliefs, and emotions. The interaction of the components determines the level of attention and motivation with which a task is processed. The metacognitive system monitors, evaluates, and regulates the cognitive processing of information. Metacognitive processing involves setting goals to accomplish the task and developing strategies for achieving the goals. Lastly, the cognitive system can be divided into four taxonomic levels: retrieval, comprehension, analysis, and knowledge utilisation. During *retrieval*, learners recall their knowledge and apply it to simple tasks. Retrieval is subdivided further into the subcategories of recognition, recall, and performance. *Understanding* involves differentiating between important and unimportant items and representing essential items graphically. Subcategories here are integrating and symbolising. *Analysis* can be divided into comparing, classifying, analysing errors, generalising, and specifying. At this level, learners can divide unknown information into units, classify those units in new contexts, and derive conclusions. Learners who use their knowledge and can transfer this knowledge to new situations are at level 4 four, *knowledge utilisation*. This can be divided into the subcategories of decision making, problem solving, experimenting, and investigating (Wagner & Huber, 2015). Marzano and Kendall's taxonomy provides a clear structure that allows different levels of the learning objectives to be distinguished and to build upon each other. Their classification system based on Bloom's taxonomy is of particular relevance because it can be applied well across the curriculum in practice.

The third level of analysis considered assessment formats and technical implementation. The choice of test format and technical implementation has implications for the usability of a test in a certain environment (Sangmeister et al., 2018). In order to assess whether there are suitable and less suitable instruments for measuring economic literacy, it is important to consider the different aspects of technical implementation and test format. Access to the subject of economics can be captured by survey formats and technical implementation. For instance, access can be linguistic-argumentative or mathematical-analytical to map action competencies in the best possible way (Winther, 2010). Both textual and visual language skills and an understanding of basic economic concepts in everyday economic contexts can be included in tests of economic literacy. Instruments for measuring economic literacy can be paper-pencil based or computer based. An example of a test environment that incorporates innovative items is *SysKo-BNE* (measuring systems competence as an indicator in education for sustainable development; Hartig & Roczen, 2020). *SysKo-BNE* was implemented in a technology-based format using the *ItemBuilder* package (Leibniz Institute for Research and Information, 2022). Innovative answer formats, such as drag-and-drop items, enabled the evaluation of results data and the collection and evaluation of process data—i.e. data that allows conclusions to be drawn about task processing—because all user inputs plus a time stamp are stored (Kroehne & Goldhammer, 2018, p. 533). Computer-based testing produces log data in log files (Goldhammer et al., 2020, p. 242; Kögler et al., 2020, p. 1). Computer-based test environments thus offer new possibilities for making individual solution strategies visible (Rausch et al., 2017, p. 569). While the added value of digitalised formats might be considerable, the technical challenges of test development and documentation might constitute a severe barrier to implementing these formats.

Finally, the fourth level of analysis studied the authenticity of the test instruments. Assessing the authenticity of the extracted measurement instruments opens up the possibility of analysing whether the test instruments are relevant to the subject's environment and the application of economic competencies in real life. Test items with a specific reference to the lifeworld are particularly relevant in authentic assessments; such test items will be dynamically designed with close reference to the real world and oriented towards abilities relevant to everyday life (Janesick, 2006; Koh, 2017). Authenticity can be staged in assessments by modelling real-life situations. Test items modelled in this way represent opportunities to apply competences that are needed in the real world (Villarroel et al., 2018). A computer-based testing environment simplifies the implementation of an authentic assessment and enables the reconstruction of test behaviour, i.e. the interaction between the test taker and the assessment.

3 METHODOLOGY

3.1 Selecting measurement instruments for analysis

This section outlines the procedure of the systematic review in more detail. The literature databases *PSYNDEX*, *ERIC*, *German Education Index*, and *GESIS* were reviewed systematically between July 2021 and October 2021 to identify relevant measurement instruments for assessing economic literacy. The *PSYNDEX* database of the Leibniz Institute for Psychology covers psychological literature from German-speaking countries (Leibniz Institute for Psychology, n.d.). *ERIC* (Education Resources Information Center) covers literature from the fields of education and teaching and is funded by the Institute of Education Sciences of the United States Department of Education (Institute of Education Sciences, n.d.). The *German Education Index* includes literature references in all subareas of education (Leibniz Institute for Research and Information in Education, n.d.); and the *GESIS* data archive includes over 6,500 German and international studies (Leibniz Institute for Social Sciences, n.d.). This paper's emphasis was on systematically collecting and analysing measurement instruments for economic literacy rather than considering instruments for measuring attitudes. This work focused on information-based knowledge rather than beliefs, self-assessments, or experiences, even though these of course also contribute to decisions (Serido 2022, p. 33). Economic literacy pertains to understanding, evaluating, and judging economic concepts and principles in order to be able to act in a well-founded manner (Soper & Walstad, 1998), while attitudes capture emotional reactions and evaluations of economic issues. Furthermore, instruments for measuring economic literacy aim to measure general understanding, factual knowledge, and procedural knowledge and understanding, whereas instruments for measuring attitudes focus on assessing affective responses. Consequently, the decision to focus on instruments for measuring economic literacy was driven by the study's objective to determine the level of knowledge and comprehension of economic concepts rather than capturing participants' attitudes.

The population intervention comparison outcome (PICO) model was deployed to conduct a systematic search (Sayers, 2007) using the following keywords:

- economic knowledge
- economic literacy
- economic competence
- financial knowledge
- financial literacy
- financial competence
- ökonomische Bildung [economic literacy]
- ökonomisches Wissen [economic knowledge]
- finanzielle Bildung [financial literacy]
- finanzielles Wissen [financial knowledge].

The keywords were combined with the terms ‘measurement instrument’; ‘*Messinstrument*’ [measurement instrument]; and ‘test’. This procedure resulted in 636 potentially relevant publications. Duplicates were removed using the literature management program Citavi, reducing the number of potentially relevant publications to 298. German- and English-language publications from 1990 onwards that resulted from quantitative empirical studies were included. Children, adolescents, and adults were defined as target groups. All publications were collected that used a measurement instrument or scale to assess basic economic literacy, or that reported on the original development or the modification or translation of a measurement instrument. Measurement instruments were not included if they were not standardised or if the sample size was too small. An attempt was made to determine the sample size and Cronbach's alpha for all measuring instruments. A Cronbach's alpha value of .7 should be achieved for adequate reliability (Beauducel & Leue, 2014). Measurement instruments were not included if neither the sample size nor Cronbach's alpha were available.

The abstracts of the 298 publications were evaluated, and full texts were selected using the above criteria. In a next step, the measurement instruments available online were located or generated by making contact with the respective authors by email or via ResearchGate. In this way, the number of potential articles was reduced to 34 publications. Of the resulting set, eight measurement instruments were eliminated because no items were detailed in the corresponding publications and there was no response to requests for access to the test items.

In total, 26 measurement instruments for economic literacy for all age groups from 1990 to 2020 including a total of 1,124 items were selected for analysis and evaluation. The eight German-language and 18 English-language tests of economic literacy were profiled in various articles. The selected measurement instruments were documented in Microsoft Excel. Analysis included the survey format and technical implementation, year of publication, mode, response formats, content formats, the perspective of the economic subject dimension, the perspective of learning psychology, and the perspective of authenticity. Table 1 provides an overview of the 26 extracted measurement instruments. In addition to the title of each instrument, the table states the country in which the instrument was developed. Furthermore, the author, publisher or institution, and year of publication are included for each instrument. In addition to general information about each measurement instrument, the table details some content-related aspects. The table includes information about the age of the target group, the question mode, and response formats. Finally, the table contains information about whether measurement instruments included items to assess mathematisation and a reference to the living environment.

Table 1. Overview of measurement instruments for economic literacy

Instrument	Country	Author, Publisher, or Institution	Year	Age of the test subjects	Question mode ¹	Question type	Requirement	
							maths	relation to living environment
Basic Economics Test (BET)	USA	Walstad, W. B.; Robson, D.	1990	10–12 (5th and 6th Grade)	PPB	single choice	no	no
Economic literacy test <i>[Wirtschaftskundlicher Bildungs-Test (WBT)]</i>	Germany, Austria and Switzerland	Beck, K.; Krumm, V.	1998	15+ (high school students)	PPB	multiple choice	yes	no
Test of Economic Knowledge (TEK)	USA	Walstad, William B.; Soper, John C.	1998	13–15 (8th and 9th Grade)	PPB	single choice	no	no
Economic literacy of secondary school students <i>[Ökonomische Bildung von Schüler/innen Allgemeinbildender Höherer Schulen (OBHS)]</i>	Austria	Brandlmaier, E.; Frank, H.; Korunka, C.; Plessnig, A.; Schopf, C.; Tamegger, K.	2005	17–18 (Grade 11 and 12)	PPB	multiple choice	yes	no
Financial Fitness for Life Test (FFFT)	USA	Walstad, W. B.; Rebeck, K.	2005	6–12 (1st to 6th Grade)	PPB	single choice	yes	yes
Test of Understanding in College Economics (TUCE)	USA	Walstad, W. B.; Watts, M.; Rebeck, K.	2006	18+ (university students)	PPB	single choice	yes	no

Jump\$start Coalition 2008 College survey (Jump\$start)	USA	Mandel, L. Merrill Lynch Foundation	2008	18+ (university students)	PPB	single choice	yes	yes
National Assessment of Educational Progress (NAEP)	USA	National Center for Education Statistics	2012	18 (12th Grade)	CBA	single choice, open response	yes	yes
The Financial Knowledge Scale (FKS)	USA	Knoll, M. A. Z.; Houts, C. R.	2012	18+	CBA	multiple choice	yes	yes
PISA Financial Literacy (PISA)	18 countries	OECD	2012	15	CBA	multiple choice, single choice, open response	yes	yes
Financial education online: does it work? (FEO)	Italy	Nicolini, G.	2012	18+	CBA	single choice	yes	no
Test of Economic Literacy 4th Edition (TEL)	USA	Walstad, W. B.; Rebeck, K.; Butters, R	2013	16–18 (high school students)	PPB, CBA	multiple choice	yes	yes
A test of minimal economic knowledge in Germany (MEK)	Germany	Wobker, I.; Lehmann- Waffenschmidt, M.; Kenning, P.; Gigerenzer, G.	2014	18–84	CATIs	multiple choice	yes	no

Economic Competencies of Students Leaving Secondary School <i>[Ökonomische Kompetenzen von Maturandinnen und Maturanden (OEKOMA)]</i>	Switzerland	Schumann, S.; Eberle, F.	2014	16–18 (high school students)	PPB	multiple choice; open response	yes	no
Impact of education on the financial literacy (IFL)	Slovakia, Czechia, Poland and Hungary	Tóth, M.; Lančarič, D.; Savov, R.	2015	18+	PPB	single choice	yes	yes
'Did you get it right?' flash cards. Maths in the area of basic financial education <i>[Stimmt's-Kärtchen. Rechnen im Bereich Finanzielle Grundbildung.]</i>	Germany	Deutsches Institut für Erwachsenenbildung	2015	18+	Interview	single choice	yes	yes
CERAFORMA	Germany	Winther, E.; Klotz, V. K.	2015	18+	CBA	multiple choice, open response	yes	yes
Test of Financial Literacy (TFL)	USA	Walstad, W. B.; Rebeck, K.	2016	14–18 (9th to 12th Grade)	CBA	single choice	no	yes

ALUSIM	Germany	Winther, E.; Seeber, S.; Weber, S.; Bley, S.; Festner, D.; Kreuzer, C.; Rudeloff, M.; Sangmeister, J.; Wiethe-Körpich, M.	2016	18+	CBA	multiple choice, open response	yes	yes
PISA 2018 released financial literacy items (PISA)	20 countries	OECD	2018	15	CBA	multiple choice, single choice, open response	yes	yes
The Financial Literacy Project (FLP)	USA	Breitbach, E.; Wagner, J.	2018	18+ (university students)		single choice	yes	yes
National Financial Capability Study (NFCS)	USA	FINRA Investor Education Foundation	2018	18+	CBA	multiple choice	yes	no
Test of economic civic competence <i>[Leistungstest Wirtschaftsbürgerliche Kompetenz (WBK-T2)]</i>	Switzerland Germany	Ackermann, N.	2018	16–18 (11th and 12th Grade)	PPB	single choice, open response	yes	yes
Test of Economic Competence (TEC)	Germany	Kaiser, T.; Oberrauch, L.; Seeber, G.	2019	12–15 (7th to 10th Grade)	PPB	multiple choice	yes	yes
Financial Literacy Test (FLT)	South Africa	Mudzingiri, C.	2019	18+ (university students)	PPB	single choice	yes	yes

Measurement of systems competence as an indicator of sustainable educational development <i>[Messung von Systemkompetenz als Indikator im Bereich Bildung für nachhaltige Entwicklung (SysKo-BNE)]</i>	Germany	Hartig, J.; Roczen, N.	2020	15–16 (9th Grade)	CBA	single choice, multiple choice, drag & drop	no	yes
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Note. ¹ PPB = paper-pencil-based; CBA = computer-based assessment; CATIs = computer assisted telephone interview

3.2 Creating the coding guideline

The model of the economic domain by Fortunati & Winther (2021) served as a theoretical reference for creating the coding guideline for the analysis of the measurement instruments. The model highlights academic dimensions and delimits economic areas of life (Ackermann 2019, pp. 63–65). The cognitive requirements of individual items can be mapped to the economic domain model via the knowledge domain and knowledge acquisition processes (Marzano & Kendall, 2008). A detailed derivation of the category descriptions of the coding guideline can be found in Fortunati & Winther (2021). Table 2 shows the subject-specific perspective, which is divided into economic content, consumer education, and business content. Sustainability was added as a cross-cutting fourth topic.

When coding each item, a choice had to be made between economic content, consumer education, and business administration. It would be advantageous to incorporate these aspects into future item development to ensure that future measurement instruments align with the target curriculum. In addition to the preceding three aspects, items were coded as to whether they related to sustainability. The coding rule stated that one or several content aspects had to be mentioned in the text explicitly or implicitly. In the case of an implicit mention, the criterion had to be constructed using a logical chain of evidence. An example item that included economic content with an explicit mention of scarcity was phrased: ‘What is meant by the statement that every economic system faces the problem of scarcity?’ (Walstad et al., 2013, p. 37). An implicit mention of scarcity was phrased: ‘Which is a basic economic question that must be answered by all economic systems?’ (Walstad et al., 2013, p. 38).

Table 2. Coding guideline: subject-specific perspective (based on Fortunati & Winther, 2021)

Dimension	Content
Economic content (Saunders, P., & Gilliard, J. V., 1995)	Fundamental economic concepts: <ul style="list-style-type: none"> • scarcity and choice (economic wants, productive resources, human resources, natural resources, capital goods) • opportunity cost and trade-offs • productivity (specialisation and the division of labour, investment in capital goods, investment in human capital, technological change, effects of government) • economic systems • economic institutions and incentives • currency exchange • money interdependence
	Microeconomic concepts: <ul style="list-style-type: none"> • markets and prices (information, incentives, rationing, the circular flow of resources, goods, services, and money payments) • supply and demand • competition and market structure • income distribution

	<ul style="list-style-type: none"> • market failures (inadequate competition, inadequate information, resource immobility) • externalities • public goods • public policy responses to market failure • the role of government (taxation, governments in the circular flow of resources, goods, services, payments) <p>Macroeconomic concepts:</p> <ul style="list-style-type: none"> • gross domestic product • aggregate supply and aggregate demand • unemployment (frictional unemployment, structural unemployment, cyclical unemployment) • inflation and deflation (demand-pull inflation, cost-push inflation, price expectations) • monetary policy • fiscal policy <p>International economic concepts:</p> <ul style="list-style-type: none"> • absolute and comparative advantage and barriers to trade • exchange rates and the balance of payments • international aspects of growth and stability
<p>Consumer education (MSB, 2019b)</p>	<p>Overarching area:</p> <ul style="list-style-type: none"> • needs and wants • lifestyle • consumption habits and responsibility • impact of design, advertising, and marketing • consumption-relevant product information and product labelling • quality and sustainability of goods and services • consumer protection, consumer rights and possibilities of enforcement, and consumer obligations • global, national, and regional contexts, and effects of consumption decisions <p>Finance, market activity, and consumer law:</p> <ul style="list-style-type: none"> • quality and transparency of financial products and services • product and service markets and alternative consumption models • wages or income • asset formation • private security and old-age provision • contracts, money, and payment transactions • use of credit and avoidance and management of over-indebtedness <p>Living, housing & mobility:</p> <ul style="list-style-type: none"> • lifestyles, trends, fashions • living and cohabitation • household management • energy and resource efficiency • climate protection • mobility and travel
<p>Business administration (based on Weber, 2017)</p>	<ul style="list-style-type: none"> • Explain the significance, function and organisation of companies • Describe, organise, and examine individual basic company functions and explain how profit/loss is generated • Analyse and assess company decisions, objectives, and scope for action from an economic, social, and ecological point of view

	<ul style="list-style-type: none"> • Explain and assess the division of labour • Examine and assess company workplaces in terms of their working conditions • Know, analyse, and assess the contractual regulation of labour relations and employment protection rights
Sustainability (KMK, 2007,2016)	According to the KMK decision 2007 and the orientation framework for the learning area of global development (2016), the aim is to anchor economic, social and ecological sustainability on a global scale in the curricula. The orientation framework establishes three fields of competence with differentiated core competencies and subcompetences for the area of economics in lower secondary school (pp. 291–293). <ul style="list-style-type: none"> • economic-ecological • economic-social • social-ecological • overall

Besides cognitive demands, the items also captured mental processing and action patterns. Table 3 illustrates the levels of analysis for the coding guideline for the perspective of learning psychology based on the taxonomy model by Marzano and Kendall (2007). A detailed derivation and the creation of comprehensive definitions and coding rules took place (Fortunati & Winther, 2021).

Table 3. Coding guideline: learning psychology perspective (based on Fortunati & Winther, 2021; Marzano & Kendall, 2006)

Comparison category	Category description		
Knowledge domain	The domain of information (declarative knowledge)	Organising ideas	Principles: Principles are specific types of generalisations that include a directed relationship between elements.
			Causal relationships: Causal relations as a principle are universally valid and influence interrelationships, effects, correlations Generalisations: Generalisations describe characteristics of classes or categories of persons, places, living beings, objects, and events. Generalisations also identify characteristics of abstractions. Examples drawn from Marzano & Kendall (2007): <ul style="list-style-type: none"> • Characteristics of persons (e.g. it takes at least two years of training to become a firefighter) • Characteristics of places (e.g. large cities have high crime rates) • Characteristics of living and nonliving things (e.g. golden retrievers are good hunting dogs;

			<p>firearms are the subject of great debate)</p> <ul style="list-style-type: none"> • Characteristics of events (e.g. the Super Bowl is a premier sporting event each year) • Characteristics of abstractions (e.g. love is one of the most powerful human emotions) 	
		Details	Time sequences: Time sequence between two or more events. Time sequences can contain causal elements.	
			Facts: Facts are a specific type of information and include information about specific people, places, living beings and objects, events, etc.	
			Vocabulary terms: Knowledge of vocabulary (individual words). General understanding of a word.	
	The domain of mental procedures	Skills	Tactics: Tactics do not comprise a specific arrangement of steps (rules). Tactics refer to general rules of application that allow some variation but are not as complex as macro processes.	
	Algorithms: Algorithms comprise a set of individual rules that are executed specifically.			
	Single rules: Application of individual rules without a subsequent event. (If X happens, Y happens).			
Knowledge acquisition processes	Self-system	The critical self is an interdependent system comprising attitudes, beliefs, and emotions. The interaction of the components determines the level of attention and motivation with which a task is processed.		
	Metacognitive-system	The metacognitive system monitors, evaluates, and regulates the cognitive processing of information, etc.		
	Cognitive system	Knowledge utilisation	The knowledge utilisation process is applied by individuals to accomplish specific tasks.	
		Analysis	The analysis process describes an expansion of existing knowledge. Already understood knowledge is processed more deeply. Deeper processing goes far beyond the conclusions reached during the initial storage of knowledge. Analysis of knowledge incorporates new information in the processing of already known information.	
		Comprehension	Understanding is the process of translating knowledge into a form suitable for long-term memory. To do this, knowledge must be structured and reduced.	
		Retrieval	Activation and transfer of knowledge from long-term memory to short-term memory.	

Assessment format and technical implementation were also recorded. This could be linguistic-argumentative, i.e. through the use of predominantly conceptual knowledge to solve a domain-related problem, or mathematical-analytical, i.e. through the use of mathematical competencies to solve a domain-related problem (Winther, 2010). Items that could be solved at a linguistic level and that tested textual and visual language skills fell into the linguistic-argumentative category. If calculation rules had to be applied to solve an item, this was categorised as mathematical-analytical. Furthermore, the coding guideline stated that items should be coded as authentic when they represented an action situation directly drawn from the target group's everyday life. Therefore, items were attributed a lifeworld reference if the action situation could be accessible to the target group even if it were somewhat removed from their daily life. On the other hand, items were not recorded with a lifeworld reference if they were objective items or included an action situation that was unfamiliar or alien to the target group (Janesick, 2006).

3.3 Coding

Coding was carried out in Excel by two independent coders who were trained research assistants from the Faculty of Educational Sciences at the University of Duisburg-Essen. The coding process was conducted between November 2021 and May 2022. The coding guideline was transferred to a Microsoft Excel 2019 table. Individual items of the measurement instruments were assigned to the various levels of analysis. The Excel table was prepared in advance with conditional formatting and drop-down menus so that only the predefined options could be entered into respective cells. Next, the text-based coding was converted into a numerical coding system so that it could be transferred into SPSS. This procedure meant that all items were coded twice. In a further step, the inputs of both coders were merged and transferred to SPSS to determine interrater reliability. Interrater reliability showed differences and similarities in the previously defined categories and formed the basis for further discussion of the codings.

Interrater reliability was tested using Cohen's kappa coefficient (κ) and Krippendorff's alpha coefficient (α). Both reliability measures consider random agreement in addition to percentage agreement. The range of values for Cohen's κ is between -1 and +1. A high κ value also shows good observer agreement. Values above .75 are classified as very good, values between .60 and .75 as good, and values between .40 and .60 as moderate (Goldhammer & Döring, 2016). Intercoder agreement using Krippendorff's α lies between 0 and 1, whereby a value of 0 stands for no or random agreement, and a value of 1 for perfect agreement (Hayes & Krippendorff, 2007, p. 82). Krippendorff called for values of at least .80 and described values from .67 as merely tentative conclusions (Krippendorff, 2004). Landis & Koch (1977) considered values between $.41 \leq \kappa \leq .60$ to be moderate agreement, $.61 \leq \kappa \leq .80$ to be substantial agreement, and $.81 \leq \kappa \leq 1.00$ to be (almost) perfect agreement.

Across categories, the interrater reliability value for the two coders was $\kappa = .817$ and

can thus be classified as very good. Table 4 shows the differences in interrater reliability between the dimensions of analysis. Overall, it can be seen that Cohen's κ and Krippendorff's α showed largely the same reliability values. With values between .66 to .88, these lay in a good to very good range. One exception was the interrater agreement on the lifeworld reference. With a value of .54, this category can be classified only as moderate or just sufficient measurement accuracy. Table 4 shows the interrater reliability with Cohen's κ and Krippendorff's α .

Table 4. Interrater reliability

Comparison category	Krippendorff's	Cohen's
	α	κ
Knowledge domain	.70	.71
Knowledge acquisition process	.66	.66
Subject-specific content	.88	.88
Sustainability reference	.82	.82
Assessment format and technical implementation	.75	.75
Lifeworld reference	.54	.54

Given the high level of agreement between the two coders' data sets, further analyses were conducted with the data set of one coder only.

4 RESULTS: DIFFERENCES BY PERSPECTIVE OF ANALYSIS

Analysis of the measurement instruments considered the four perspectives under investigation. For the economic subject dimension, economic and business content, consumer education, and sustainable development were analysed. For learning psychology, analyses determined which cognitive demand level was implemented in the learning and subject-specific perspectives with a specific focus on knowledge acquisition processes and knowledge dimensions. The analysis of assessment formats and technical implementation identified what survey mode was being used, i.e. paper-pencil or a computer-based test environment, and recorded cognitive load by documenting the technical approach, i.e. mathematical-analytical or linguistic-argumentative. Finally, to assess authenticity, the lifeworld reference of the target group of the various test instruments was mapped.

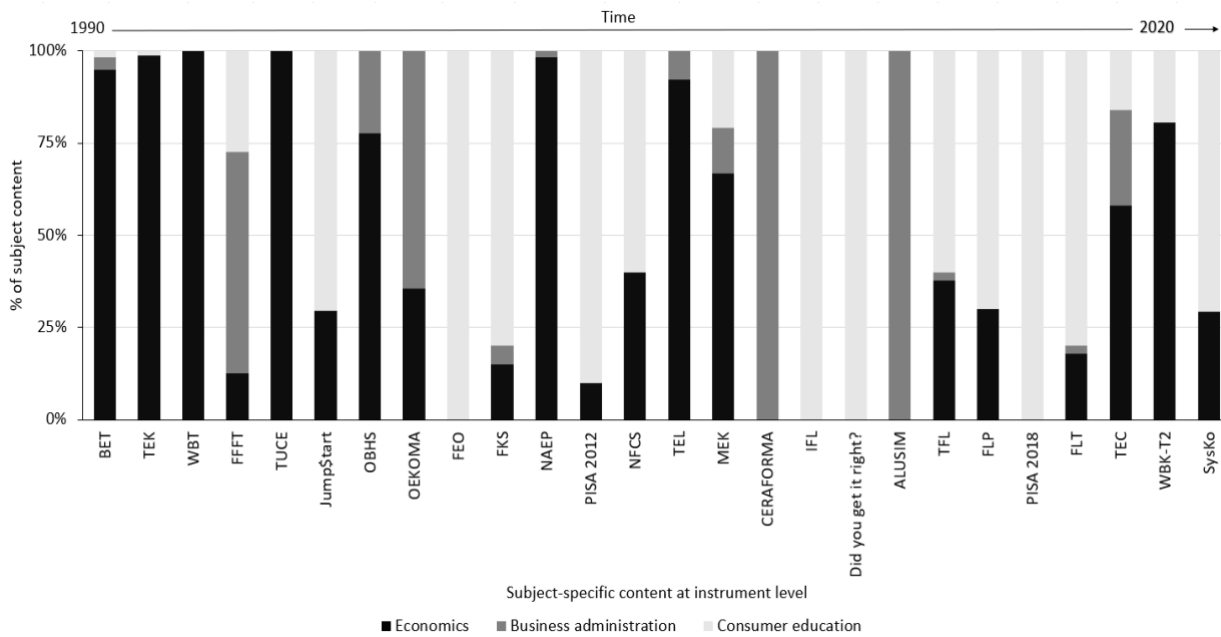
4.1 Perspective of economic dimension

Economic knowledge was the focus of the subject-related content in ten test environments. Only four test environments focused on business administration, but twelve test environments focused on consumer education. Test instruments often attempted to map a subdomain completely within the economic domain. However, they did not strive to

represent the different domains of economics, business administration, and consumer education in equal parts. Even though there was overlap between the areas, great care was taken during coding to code exclusively by area of focus. This means that it was possible to analyse the assignment of the various measurement instruments to the individual dimensions. That said, the financial fitness for life test (FFFT) and the test of economic competence (TEC) were exceptions to this rule as they each attempted to cover all subdomains, although not in equal parts. The content of the FFFT was divided into 13% economics, 60% business administration, and 28% consumer education, and the content of the TEC was divided into 58% economics, 26% business administration, and 16% consumer education. Apart from these exceptions, a series of measurement instruments only mapped one domain: seven of the 26 test environments mapped 100% of only one subdomain; and 13 test environments focused on one subdomain; 17 measurement instruments focused on one subdomain to more than 75%.

Figure 1 compares the development of the various dimensions of subject content over time. Economics and consumer education stand out in particular. Overall, ten measurement instruments focused on economics, four measurement instruments focused on business administration, and eleven measurement instruments focused on consumer education. There was a significant negative correlation of $-.558^{**}$ between the year of publication and the occurrence of test items on economics, and a significant positive correlation of $.444^*$ between the year of publication and the occurrence of test items on consumer education. In other words, as time progressed, fewer items relating to economics and more items relating to consumer education were asked. The first measurement instrument to include a focus on consumer education was Jump\$start in 2008. Since then, most of the published test instruments have started to focus on consumer education, dedicating more than 50% of the test items to this dimension. The test instruments and their respective level of focus on the different content areas are shown in Figure 1.

Figure 1. Comparison of subject content for all measurement instruments



But even after 2008, the focus was not only on consumer education. Concerning consumer education in financial literacy, the PISA surveys from 2012 and 2018 provided added value. The focus of these two tests was on consumer perspectives, specifically on dealing with issues relating to personal finances. This means that not all test instruments were designed for secondary school education, but also for vocational and adult education.

In terms of the content area of sustainability, twelve of the 26 test instruments included items with a reference to sustainability. Until 2010, the maximum noted proportion of items with a recognisable reference to sustainability was 5%. In PISA 2012 and 2018, sustainability-related items were expanded as a separate topic, with 10% relating to sustainability in the 2012 edition, and 23% in the 2018 edition. The systematic analysis highlighted SysKo-BNE (2020) as an instrument that focused on sustainability to a very significant extent, with 79% of the items in this instrument including a reference to sustainability.

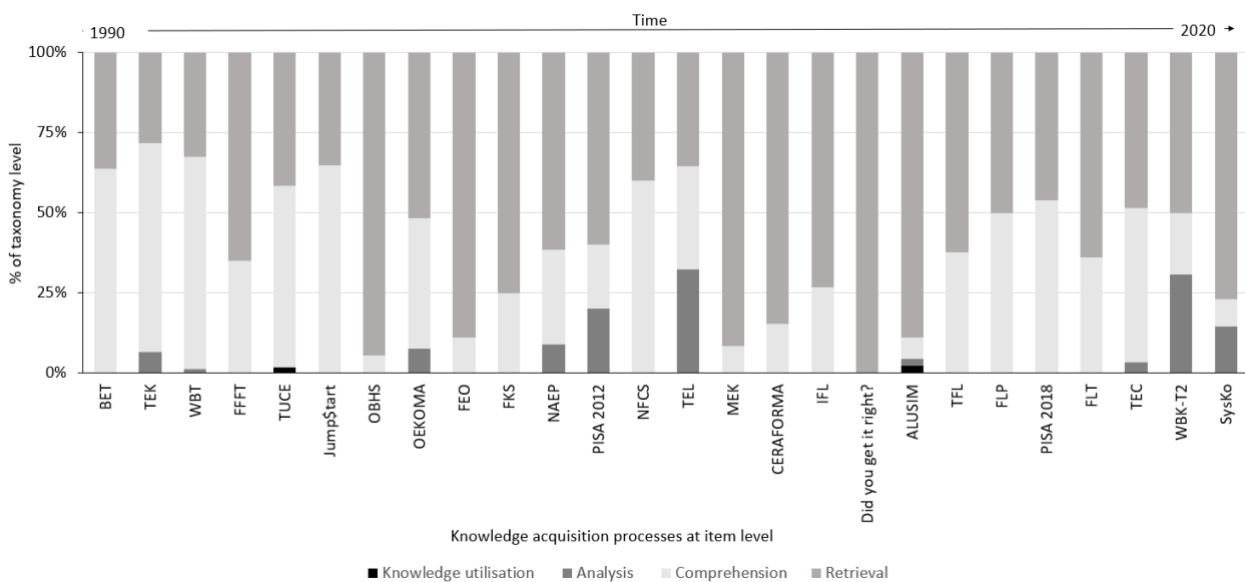
4.2 Perspective of learning psychology

The investigated test instruments exhibited a clear focus on the retrieval of declarative knowledge. At least 1,061 items (67%) drawn from all measurement instruments could be assigned to the information domain. Additionally, 15 of the 26 test environments also used items that tested procedural knowledge, with a total of 63 items. Items in the knowledge domain were constructed largely in a linguistic-argumentative format. Items in the domain of mental processes used a mathematical-analytical approach in 76% of cases.

At the perspective of learning psychology, all 1,124 items could be assigned to the

cognitive system. Figure 2 illustrates the comparison of the items exploring knowledge acquisition processes across all test environments. At the cognitive level, the categories of retrieval and comprehension were addressed most frequently; analysis and knowledge utilisation were represented significantly less frequently. Looking at knowledge acquisition processes across all measurement instruments over time, it is noticeable that knowledge utilisation was surveyed only by two measurement instruments, TUCE (2006) and ALUSIM (2016). The cognitive level analysis was queried at irregular time intervals. However, the three most recent test instruments—TEC (2019), WBK-T2 (2019), and Sysko-BNE (2020)—mapped this level. While it is too early to speak of a trend here, it is intriguing to note how the dimension has been evolving. The frequency of the cognitive level of comprehension was most relevant until 2008. In the transition from 2008 to 2009, the focus shifted to retrieval.

Figure 2. Comparison of knowledge acquisition processes across all measurement instruments



4.3 Perspective of survey formats and technical implementation

Measurement instruments addressed different target age groups as follows: 13 of the surveyed instruments (50%) were developed for adults over 18 years of age; one instrument each (4%) addressed students in grade one to six, grade five to six, grade seven to ten, and grade nine to twelve, respectively; two instruments were developed each for measuring economic literacy in grade eight to nine, and grade eleven and twelve; and five instruments (19%) addressed the upper secondary level with students of 15 years and older but did not specify a grade. In summary, measurement of economic literacy for students under and over 18 years of age was on an equal footing. Table 5 shows the target groups for all measurement instruments.

Table 5. Target groups for all measurement instruments

Target groups	Measurement instruments	Percentage
Grade 1 to 6	FFFT	4%
Grade 5 to 6	BET	4%
Grade 7 to 10	TEC	4%
Grade 8 to 9	TEK; SysKo-BNE	8%
Grade 9 to 12	TFL	4%
Grade 11 to 12	OBHS; WBK-T2	8%
Upper secondary level (15+)	WBT; PISA 2012; TEL; OEKOMA; PISA 2018;	19%
Adults over 18 years	TUCE; Jumpstart; NAEP; FKS; FEO; MEK; IFL; Did you get it right?; CERAFORMA; ALUSIM; FLP; NFCS; FLT	50%

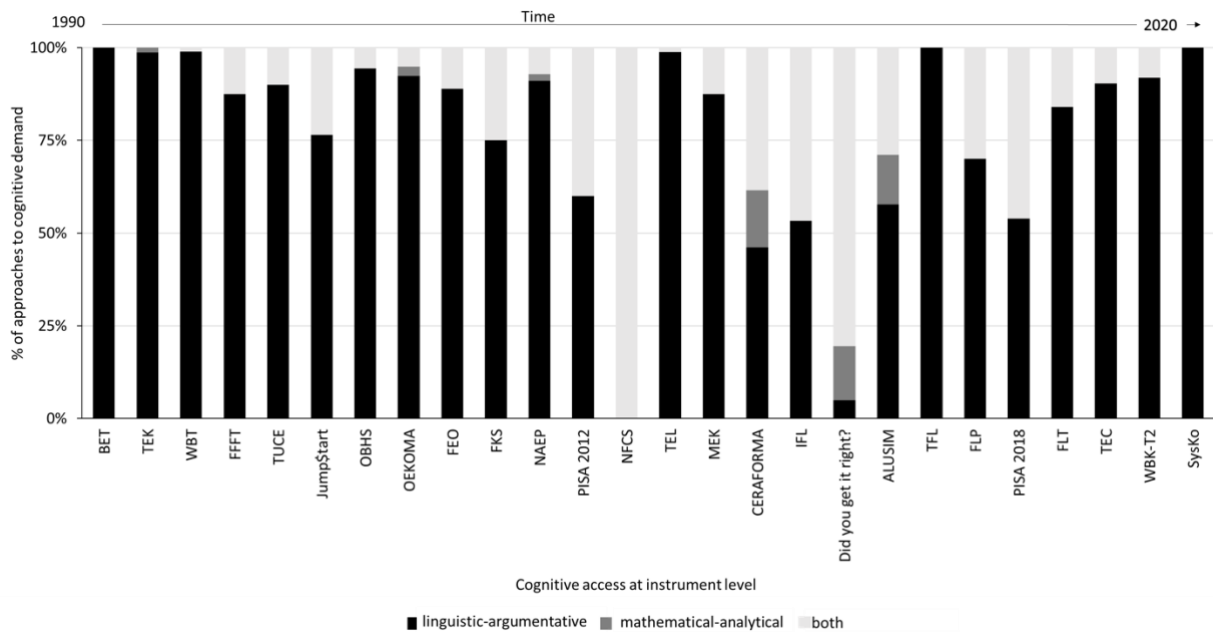
Looking at survey mode, eleven of the assessments of economic literacy were implemented as paper-pencil surveys, 14 measurement instruments were computer based, and two test environments involved interviews. In one test environment, both a computer-based and a paper-pencil survey were implemented. Overall, 100% of the surveyed test instruments were paper based between 1990 and 2010. Only from 2011 onwards were test environments implemented in a computer-based format. Between 2011 and 2020, 58% of the test environments were computer based, 32% paper based, and 11% interview based.

The measuring instruments used different answer formats to capture the economic literacy of the different target groups. A total of eleven measurement instruments (42%) used single-choice questions only; seven measurement instruments (27%) relied purely on multiple-choice questions; and three measurement instruments (12%) used free-text answers in addition to multiple-choice questions. A further two measurement instruments (8%) used a combination of single-choice questions and free-text answers, and two measurement instruments (8%) used a mixture of multiple-choice, single-choice, and free-text answers. Only the Sysko-BNE measurement instrument used drag-and-drop fields as an answer format.

In terms of cognition, 24 of 26 test environments focused on a linguistic-argumentative approach. The test environments NFCS and Did You Get It Right? had a mixed approach. However, most of the test environments did not pursue a purely linguistic-argumentative approach. Exceptions were BET, TFL, and SysKo-BNE. There were enormous differences between the approaches towards cognitive demand in the various test environments. Overall, 67.62% of all items had a linguistic-argumentative approach and 21.50% had a mathematical-analytical approach. Only a few test environments (ALUSIM, Did You Get It Right?, CERAFORMA, NAEP, FIS, OEKOMA, TEK) had items that were purely mathematical-analytical. Figure 3 illustrates the changes and emphases in subject access of all test

instruments. There was no significant correlation between the approach to cognitive demand and the year of publication of the measurement instrument.

Figure 3. Comparison of the approach to cognitive demand across all measurement instruments



4.4 Perspective of authenticity

Of the 26 test environments, 22 had items with a lifeworld reference. More specifically, 41% of the test environments had at least 40% of items that were related to the lifeworld (OBHS = 40%; FLP = 40%; IFL = 46.67%; FLT = 50%; Did You Get It Right? = 60.98%; Jump\$start = 64.71%; PISA 2012 = 90%; CERAFORMA = 100%; PISA 2018 = 100%) and thus aimed to implement an almost complete lifeworld reference. However, only the CERAFORMA and PISA 2018 test environments had 100% lifeworld-related items.

There was a significant difference in how the instruments implemented proximity to the lifeworld. The items modelled in PISA offered respondents the opportunity to relate item content to their lifeworld. However, there was no relationship between the tasks and no overarching narrative. This was solved differently in CERAFORMA, where a company was realistically modelled in the authentic test environment.

There was no significant correlation between the year of publication and the percentage of lifeworld reference. That said, between 1990 and 2000, none of the test environments implemented a lifeworld references. Jump\$start was the first test environment to incorporate a recognisable lifeworld reference (64.71%) in 2008. Lastly, there was no significant correlation between real-life items and the technical implementation of the test environment.

5 DISCUSSION

This paper has analysed how the instruments for measuring economic literacy have changed over the past three decades. The focus was on the requirements that an economically literate person must fulfil. Therefore, a systematic review of the databases PSYNDEX, ERIC, German Education Index, and GESIS was conducted. A total of 26 German- and English-language measurement instruments used between 1990 and 2020 was examined and analysed from four perspectives: (1) economic subject dimension, (2) learning psychology levels, (3) assessment formats and technical implementation, and (4) authenticity. The findings on each perspective provide a basis for shaping future assessments more consciously.

The authors would like to point out that the results of the present analysis outline only a subset of the measurement instruments in economic literacy. Only German- and English-language measurement instruments were conceptualised in the analysis. Some measurement instruments were excluded by the criteria defined for this systematic review, while others were not accessible. Moreover, the results are based on a qualitative content analysis by individual researchers. All in all, the results should therefore be interpreted only in the light of the exclusion criteria and cannot be regarded as internationally representative for all economic testing. That said, the high interrater reliability between the two coders' data sets enabled a certain comparability, and for the time being, a more comprehensive overview is not available.

Results of the analysis of the economic subject dimension showed that the measurement instruments focused on one domain at a time rather than measuring all domains to the same extent. Economic knowledge was the primary focus in ten test environments. A focus on consumer education increased strongly after 2008, and sustainability was a cross-cutting theme within twelve of the 26 measurement instruments. The importance of consumer education and sustainability is expected to continue to increase. A one-dimensional focus might be practical in vocational education, if at all; however, in general education settings, curricula and assessments should avoid approaches that do not integrate multiple content dimensions. In developing future measurement instruments, consideration should be given to aiming for a balanced and comprehensive measurement of economic literacy. If this is not the desired outcome, the dimensions that have been considered and the context suggesting this should be explained.

Regarding the psychology of learning levels, the test instruments focused on the retrieval of declarative knowledge. Overall, 67% of items of the surveyed measurement instruments could be assigned to the information domain and used a mostly linguistic-argumentative approach. Items in the domain of mental processes used a mathematical-analytical approach in 76% of cases. All test items could be assigned to the cognitive level, in which retrieval and comprehension categories were most frequently represented. For an authentic assessment, it can be assumed that the categories of analysis and knowledge utilisation would be used more frequently to depict items that are close to the real world.

Retrieving factual knowledge is a fundamental condition for understanding and applying economic concepts. This could be an explanation for the observed emerging prevalence of this focus. Another, more practical reason for focusing on retrieval and comprehension might be that test items relating to analysis and knowledge utilisation are more difficult to develop. However, focusing on measuring factual knowledge may not adequately capture how well test takers can apply economic literacy in real economic situations or how well they can analyse complex problems. Therefore, a bias in the connection between test scores and basic economic literacy cannot be excluded. In the future, digitalisation could enhance the development of more complex and authentic measurement instruments, covering more items that are more application oriented. This would contribute to a more accurate assessment of economic competence.

The analysis of assessment formats and technical implementation illustrated that 50% of the measurement instruments were developed for adults over 18. The measurement instruments for students under 18 years of age were divided between grades 1 to 12. Technology-based assessments were not centrally represented in the surveyed measurement instruments. Only 14 out of 26 instruments were computer based. Overall, single-choice responses were selected as the predominant response format (42%), followed by multiple-choice fields (27%). Only one measurement instrument resorted to the use of drag-and-drop items. In terms of cognitive demand, 24 of the 26 test environments focused on linguistic-argumentative tasks for subject access. Only 7 test environments had some purely mathematical-analytical items. Overall, 67.62% of all items had a linguistic-argumentative approach, 21.50% had a mathematical-analytical approach, and only 1.88% of the items were purely mathematical-analytical. The advantages that a technology-based implementation could bring were not being exploited. Technology-based assessments offer the opportunity to measure a broader understanding of economic competencies by constructing interactive and lifeworld tasks. Unfortunately, the effort required and a lack of resources might have prevented technology-based assessments with innovative response formats from being implemented in some cases. Overall, the use of new technologies and innovative measurement tools lagged far behind more traditional formats.

Despite the high relevance attributed to implementing a lifeworld reference in measurement instruments, the review of the perspective of authenticity highlighted that the anchoring of authenticity in test formats was still being insufficiently implemented. Measurement instruments that were fully integrated into an authentic setting were the exception. Only the PISA 2018 and CERAFORMA measurement instruments modelled an authentic test environment that was strongly oriented towards the lifeworld of the target group. Besides authentically embedding individual items, the entire test environment was adapted to the lifeworld. The results of the analyses of the measurement instruments showed that structural anchoring of the lifeworld reference in measurement instruments has started to emerge, but with strong differences, especially among countries. A lack of authenticity in measurement instruments might lead to negative motivational effects as

test takers cannot identify with the contexts. Including authentic materials and realistic tasks can lead to more accurate and meaningful results and improve the preparation of test takers for real economic challenges.

In summary, this paper offers an overview of the development of measurement tools in economic literacy through a systematic review. Developments in society and in economic literacy have left clear traces in measurement instruments. When developing future measurement instruments, researchers should choose and describe their focus consciously and conscientiously. Furthermore, if the intention is to develop a measurement instrument that measures general economic competencies, the focus of the instrument must be multidimensional. In addition to implementing innovative response formats, an authentic technology-based instrument development offers the possibility to measure complex thought processes rather than only factual knowledge. Therefore, the use of authentic assessments also allows a more accurate assessment of economic literacy.

In further research, it might be interesting to examine the predominant thematic approach to the economic domain in testing environments. This is of specific relevance when economic literacy is part of a broader curriculum that includes the neighbouring social sciences with alternative views on the economy. For a similar reason, it would be interesting to analyse which of the dimensions are independent and which are characterised by significant correlations among each other. Such analysis might help to construct the curriculum in a more comprehensive way. And lastly, analysing the group-specific item difficulty of tests would be of particular importance in this field because various item and test characteristics might make a test more or less difficult for specific groups and thus reduce test fairness.

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AUTHOR BIOGRAPHIES

Nina Charlotte Johanna Welsandt is a research assistant at the University of Duisburg-Essen, Germany. She is interested in the effects of digitalisation on the construction of measurement instruments for economic literacy. The major topic of her dissertation is the role of authenticity and technology in testing environments.

Hermann Josef Abs is a professor in the Faculty of Educational Science at the University of Duisburg-Essen. His research focuses on the interplay of societal change and education in the areas of citizenship education and teacher education.