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Article

How Gender and Primary Language Influence the Acquisition of Economic Knowledge of Secondary School Students in the United States and Germany

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Abstract: Economics has become an essential component of secondary school curricula in many countries as a result of the growing awareness that young adults need fundamental economic knowledge to manage their personal finances. Accordingly, an increasing number of comparative studies are being conducted of commonalities and differences in students' economic knowledge and its most decisive influencing factors within and across countries. In this study, we compare the performance of secondary school students in the United States (N = 3517) and Germany (N = 983) on the fourth version of the Test of Economic Literacy. We investigate two personal characteristics that have been found to influence the students' acquisition of economic knowledge: gender and primary language. Although these two characteristics have been considered in numerous studies of economic education in both countries, they have not been investigated together in an international comparison, which would allow more effective pedagogical approaches for economic education to be formulated. We found male students in both countries exhibited greater economic knowledge, and students whose primary language was the same as the national language performed better. We discuss implications for economic education in both countries and cross-nationally.

Keywords: economic knowledge; Test of Economic Literacy; secondary school students; comparative analyses; gender; primary language; multi-level analysis



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1. Introduction

Young adults need economic knowledge to understand various economic developments and economic topics in the media, such as inflation, unemployment, supply and demand for goods (Siegfried 2016), and to participate actively and independently in society (Happ and Zlatkin-Troitschanskaia 2021; Liening 2019; Moryl 2016; Roche Carioti 2020). Against this background, economic education recently has undergone a significant “re-evaluation” in secondary school curricula in the United States (US) and Germany, two leading Western industrial nations. For instance, the *Voluntary National Content Standards in Economics* of the Council for Economic Education (CEE) have been included in the K-12 standards in 50 US states (CEE 2010). In 25 US states, secondary school students are required to complete an economics course (CEE 2022). In Germany, federal states have been adding more economic content to secondary school curricula, and in the state of Baden-Württemberg, for example, economics has been a compulsory subject for all secondary school students since 2016 (Oberrauch and Kaiser 2019).

In this context, comparative studies of the commonalities and differences in students' economic knowledge and its most decisive influencing factors across and between countries have gained importance. The US and Germany, have a common orientation toward

economic education, which is clearly reflected in the fact that the same textbooks are used in these countries in translated and adapted versions (see, e.g., the American and German versions of Mankiw 2020). Findings from comparative studies are essential not only for the appropriate design and adaptation of economics textbooks, but also for accurate identification of challenges learners in both countries face in economic education.

In this article, we present a comparative study of the performance of secondary school students in the US and Germany on the fourth version of the Test of Economic Literacy (TEL4, Walstad et al. 2013). The original TEL4 was developed by the CEE for use in an Anglo-American dominated context to assess the economic knowledge of students in secondary school. It is based on the CEE's 20 content standards for knowledge in fundamental areas of modern economics agreed upon by international experts in this domain. This content has proven to be valid for economic curricula in Germany as well (Förster et al. 2017). Therefore, we translated, adapted, and validated the original English language version of the TEL4 for use in the secondary school context in Germany (Förster et al. 2015). We use both validated test versions to conduct the comparative analysis in this study.

In the literature, gender (Asarta et al. 2014; Jackstadt and Grootaert 1980; Walstad and Robson 1997) and primary language (Walstad et al. 2013) are repeatedly discussed as important factors influencing students' acquisition of economic knowledge in the US. These two personal characteristics are also discussed as relevant determinants of students' economic knowledge in Germany (Kaiser et al. 2020; Schlax et al. 2020). Although in some studies conducted at the college level a comparable test of economic knowledge has been employed in the US and Germany (Brückner et al. 2015), no study has been conducted at the secondary school level using an adapted and, therefore, comparable test to analyze the influence of the two characteristics in both countries. This may be due to the lack of comparable test instruments for different countries and the challenges in assessing data at a secondary school level (for example, due to smaller classes than in college and stricter data regulations for secondary school students than college students). However, such findings are important for designing or adapting textbooks for secondary school economic education because they shed light on the kinds of challenges economics students in both countries face and offer indications as to how textbooks can be better designed or adapted to be learner oriented.

In studies conducted in the US or in Germany, male students have performed better on economic knowledge test items (for the US, see Asarta et al. 2014; Walstad et al. 2013; for Germany, see Förster and Happ 2019). Similarly, students whose primary language was not the same as the national language were at a disadvantage in both countries when performing economic tasks (for the US, see Walstad et al. 2013; for Germany, see Happ et al. 2021). However, these studies were conducted separately in each country. In this paper, we investigate the role of these two personal characteristics on students' acquisition of economic knowledge across and between the US and Germany at the secondary school level in one study, and we address the following two research questions (RQs):

RQ1: Does gender influence the acquisition of economic knowledge, and if so in which of the two countries is this influence more pronounced?

RQ2: Does primary language influence the acquisition of economic knowledge, and if so in which of the countries is this influence more pronounced?

In Section 2, we describe, both theoretically and conceptually, economic knowledge as the construct to be assessed. Further, we explore the literature on economic knowledge in the US and Germany, and we present our hypotheses to be tested. In Section 3, we introduce the test instrument (i.e., the TEL4) used to assess economic knowledge, and we describe our sample of secondary school students from the US and Germany. In Section 4, we present the results of our measurement invariance analyses, and we use multilevel modeling of the results to test our hypotheses. In Section 5, we outline the limitations of this study and implications for economic education in both countries.

2. Conceptual and Theoretical Background

2.1. Economic Knowledge

Economic knowledge is built on fundamental disciplinary concepts and models in this domain (e.g., [Krugman 2021](#); [Mankiw 2020](#)). The 20 content standards established by the CEE (2010) are considered essential elements of differentiated economic content. They comprise basic economic principles, such as scarcity, allocation of goods, trade, markets and prices, and competition, as well as core economic concepts, such as market failure, state failure, and inflation. The 20 content standards were developed by distinguished university professors and are now included in secondary school economics curricula in 22 US states. Also, In Germany these content standards form the basis of economic education ([Förster et al. 2017](#)).

The 45 items on the TEL4 ([Walstad et al. 2013](#)) are based on these content standards and were developed to measure economic knowledge (for details, see Section 3). In Table 1, the 20 core standards and corresponding TEL4 items are shown.

Table 1. CEE Standards and TEL4 Items.

TEL4 Item Number	CEE Standard
1, 2, 3	1 Scarcity, choice, productive resources
4	2 Decision-making, marginal analysis
5, * 6	3 Economic systems and allocation mechanisms
7, * 8	4 Economic incentives—prices, wages, profits, etc.
9	5 Voluntary exchange and trade
10	5 Voluntary exchange and trade
11, 12	6 Specialization and comparative advantage
13	7 Markets and prices
14	7 Markets and prices
15, 16, 17	8 Supply and demand
18, * 19, 20	9 Competition
21, 22	10 Economic institutions
23, 24, * 25	11 Money and inflation
26, 27	12 Interest rates
28, 29 *	13 Labor markets and income
30	14 Entrepreneurship
31, 32	15 Physical and human capital investment
33, 34 *	16 Economic role of government
35	17 Government failure, special interest groups
36 *	18 Output, income, employment, and price level
37, 38	18 Output, income, employment, and price level
39, 40	18 Output, income, employment, and price level
41, 42	19 Unemployment and inflation
43, * 44, 45	20 Fiscal and monetary policy

* Anchor item.

2.2. State of Comparative Research on the Economic Knowledge of Secondary School Students in the US and Germany and Its Influencing Factors

Comparison of the performance of secondary school students in the US and Germany on tests of economics has a long tradition ([Beck and Krumm 1991](#); [Whitehead and Halil 1991](#)). When administering the second edition of the American Test of Economic Literacy (TEL2; [Soper and Walstad 1987](#)), only minor, non-significant differences in economic knowledge were found between secondary school students in the US and Germany. Students in the US (48%) performed only slightly better than students in Germany (45%) with a 3% difference in solution frequency. However, no recent study has been conducted in which a comparison is made of the economic knowledge of secondary school students in the US and Germany. While some studies have been conducted of college students (see, for example, [Brückner et al. 2015](#)), the findings cannot be used to draw conclusions about economic education at the secondary school level. Over the past several decades,

efforts have been made in both countries to expand the economics curricula for secondary school (for US secondary school mandates, see [CEE 2022](#); for similar developments in Germany, see [Oberrauch and Kaiser 2019](#)). Correspondingly, more studies of economics in secondary education have been conducted at the national level (e.g., for Germany, see [Kraitzek et al. 2022](#)). However, the instruments used in these studies were not the same, and so comparison of the results may be inaccurate. In this study, we address this research desideratum by analyzing data gathered with the same test instrument in both the US and Germany, and our first hypothesis is as follows:

H1. *There are no significant differences in economic knowledge between secondary school students in the US and those in Germany.*

In both the US and Germany, gender has correlated with students' economic knowledge (for the US, see [Asarta et al. 2014](#); for Germany, see [Förster and Happ 2019](#); [Kaiser et al. 2020](#)). In most studies of economic knowledge, a gender gap favoring male students has been found (for the US, see [Bayer and Wilcox 2019](#); for Germany, see [Kaiser et al. 2020](#); [Jüttler and Schumann 2019](#); [Schlax et al. 2020](#)). On the basis of this previous research, the following two hypotheses related to gender are derived:

H.2.1. *Male students in Germany perform better on the test of economic knowledge than female students.*

H.2.2. *Male students in the US perform better on the test of economic knowledge than female students.*

This gender effect on secondary school students' performance on tests of economic knowledge has not yet been compared between the US and Germany. The items of the TEL4 are formulated in a closed-item format (single-choice format); however, the current research on the use of multiple-choice (MC) items has revealed that the MC response format might be a greater hurdle for students in Germany than for students in the US, as the latter have more experience with this test format ([Reusser 2009](#)). Research conducted in Germany also has revealed that test item format leads to inequality between the genders ([Lind 2009](#)). Thus, the following hypothesis is formulated:

H.2.3. *The gender gap in economic knowledge in favor of male students is greater in Germany than in the US.*

In recent years, the number of youths with a migration background has risen considerably in both the US and Germany. In 2016, for instance, newcomers to Germany under the age of 20 comprised 17.7% of the national population ([BPB 2018](#)), and 10% of students in public schools in the US were registered as non-native speakers of the national language ([MPI 2017](#)). Research has revealed that students whose first language is not the same as the language of instruction are at a disadvantage in terms of learning success ([Morek and Heller 2012](#); [Schrader and Gogolin 2019](#)), and thus the acquisition of economic knowledge may depend heavily on students' abilities in the language of instruction ([Schlax et al. 2020](#)).

From a quantitative perspective, these statistical explanations of migration background make it clear that in both the US and Germany a significant proportion of students have a migration background; however, from a conceptual perspective, the explanations also show indicators of migration background differ between the two countries. Nationality (i.e., where someone is born), home language (i.e., the language spoken in the family), and many other indicators are used in the two countries as indicators of migration background ([Callahan and Humphries 2016](#); [Happ and Förster 2019](#)). In this paper, the students' primary language (i.e., the language they feel most confident using), being English, German, or a language other than the national language, serves as an indicator of migration background. Language skills are considered a prerequisite for knowledge acquisition in general; however, it is especially important in economic education where technical terms (opportunity costs, inflation, etc.) are widely used. For this reason, in our study we investigate students' language skills. The students with a migration background complete a self-assessment of

how well they communicate in the national language (i.e., English or German) compared to their home language.¹

In the US, few studies have been conducted of language-related differences in the economic knowledge of secondary school students, and results of those studies are inconsistent with some showing significant effects (Walstad et al. 2013) and others showing none (Brückner et al. 2015; Walstad et al. 2007). The latter, however, were of young adults who had just graduated from secondary school and started college studies. Since, in addition to a sufficiently good grade point average, advanced language skills are required in college, it can be assumed that those non-native speakers who have less command of the language of instruction will not be able to enter college. Therefore, the proportion of non-native speakers who were at a disadvantage at school because of the language of instruction may not be represented among first-year college students, which may distort the potential effects compared to analyses that focused on secondary school students. Based on the current state of research, two hypotheses concerning the connection between primary language and economic knowledge are formulated as follows:

H3.1. *In Germany, students whose language skills are better in a language other than German perform worse on the test of economics (TEL4).*

H3.2. *In the US, students whose language skills are better in a language other than English perform worse on the test of economics (TEL4).*

English is taught at school and spoken in public and private spheres for a variety of purposes in many countries around the world (Nunan 2003; Genc and Bada 2010), thus many youths have exposure to English. By contrast, few people learn German at school or have exposure to German in their countries of origin (Foreign Office Germany 2015; Kushner 2003). Accordingly, it can be assumed that students who come to the US have had some exposure to the English language (Surkamp and Viebrock 2018), whereas students who come to Germany likely have not had exposure to German (Schnepf 2007). As a difference in the language effect can be expected, we will test the following hypothesis:

H3.3. *The language effect on economic knowledge is greater in Germany than in the US.*

3. Test Instrument and Sample

The data analyzed in this comparative study were gathered using the original, English language, Anglo-American oriented version of the TEL4 (Walstad et al. 2013) and its adapted and validated version for use in Germany (Förster et al. 2017). There are two parallel versions (A and B) of the TEL4. Both are MC tests containing 45 items, each with four answers from which to choose. The items present short descriptions of economic problems. The test takers are informed beforehand that there is only one correct answer for each item. To compare the two TEL4 versions, there are 10 identical anchor items in each version. To create the German test version, first in 2015, the original TEL4 was translated (with annotations) into German by professional translators specialized in economics to ensure equivalence. The Test Adaptation Guidelines (TAGs) outlined by the International Test Commission (ITC 2017) were followed to meet the highest academic quality standards (for more details on the adaptation, see Förster et al. 2015). Only a few test items required additional cultural adaptation, and all the items of the TEL4 were successfully adapted and validated for the German education context.

We analyzed data from the following two assessments: Germany: version A of the German adaptation of the TEL4 was administered to 983 students in 2015; and the US, versions A and B of the TEL4 were administered to 3517 students in 2013.² Table 2 provides an overview of the samples.

Table 2. Overview of the Samples from the Two Countries.

		US	Germany
Total sample size		3517	983
Gender			
	Male	1774 (50.4%)	475 (48.32%)
	Female	1743 (49.6%)	508 (51.68%)
Primary language or strongest language skills			
	National language	3224 (91.67%)	812 (85.8%)
	National language and other language equally strong	61 (1.73%)	140 (14.78%)
	Language other than national language	232 (6.60%)	31 (3.27%)

Although both samples are not representative, they are comparable in terms of the key demographic characteristics, for example, the gender ratio of the samples was balanced. In both countries, most respondents claimed their primary language was the national language (English or German). In the sample from Germany, the second most frequent statement made by students was that they spoke German as well as any other language. Only a few students in the sample from Germany claimed they spoke a language other than the national language better. In the sample from the US, this ratio was reversed with far more test takers claiming they spoke a language other than English better. Only a few test takers in the sample from the US claimed they spoke English and a language other than English equally well (for limitations, see Section 5.2).

4. Results

4.1. Measurement Invariance Analyses

Before conducting comparative analyses to test hypotheses 1–3, measurement invariance had to be established to verify comparability of the two assessments (Borsboom et al. 2008). Measurement invariance analyses are standard practice in large-scale assessments in the education sector (Svetina and Rutkowski 2017; Torsheim et al. 2012) to test whether the factor structure is similar when using the TEL4 versions, and thus the TEL4 measures invariantly in comparisons of groups (here, the US and Germany).

The measurement invariance analysis in this paper involves the measurement model (measurement invariance), theoretical considerations, as well as the operationalization of the same construct (construct equivalence). Three levels of measurement invariance were tested to determine whether the TEL4 measures the same construct in the US and Germany.

1. The first level is configurable measurement invariance, which means the same factor structure is present in both the US and German versions of the TEL4. Here, the theoretical assumption of the test developers for the US version (Walstad et al. 2013) is tested in terms of whether the TEL4 is one-dimensional also in Germany.
2. The second level is metric invariance, which means all factor charges between the two countries are equated and all items on the US and German versions of the TEL4 can be assumed to have the same selectivity.
3. The third level is scalar invariance, which means item intercepts (or in IRT language: item difficulties) of the TEL4 can be assumed to be the same in the US and German samples.

In Table 3, the findings of configural, metric, and scalar measurement invariance analyses for the US and German data sets are presented. In the model evaluation at all three levels, global fit indexes are used. If the Root Mean Square Error of Approximation (RMSEA) is less than 0.05, the models show a good fit. In addition, the Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI) were used. Both should be at least greater than 0.90; better would be greater than 0.95 (Rutkowski and Svetina 2014). Results of the

measurement invariance analyses indicate that three items (numbers 6, 14, and 45) needed to be omitted from the TEL4 for comparison between the US and Germany as they do not exhibit targeted metric or even scalar invariance. The remaining 42 items were included in further analyses (see Section 4.2). Accordingly, in this analysis, the highest possible total score was 42 points.

Table 3. Results of the Measurement Invariance Analyses.

US/Germany Data Set	Configural	Metric (Partial)	Scalar (Partial)
χ^2	2568.58	3654.51	5227.77
Df	1890	1932	1973
p-Value	0	0	0
df/ χ^2	1.359	1.892	2.649
RMSEA	0.012	0.019	0.026
p-Value	1	1	1
CFI	0.999	0.975	0.952
TLI	0.999	0.974	0.952

4.2. Multi-Level Modeling

Assessing students at different schools results in nested data, since clearly definable units exist within each level, and each lower unit (student) can be clearly assigned to a higher level (class). Thus, a simple regression analysis in the dataset could lead to distortions (Hox 2010). By using multi-level modelling, similarities between students within a class compared to students in other classes can be determined, since the variation in response variables is decomposed into the variance within and between classes (Snijders and Bosker 2012). The intra-class correlation coefficient (ICC) indicates the proportion of the variance that occurs at the 2nd level (class) in relation to the total variance. The ICC was high at 39.33%, that is, more than 1/3 of the variance could be explained by differences between schools (Hox 2010), confirming the need for multi-level modelling for this nested dataset.

In Table 4, the findings from multi-level modelling are shown. The sum score from the number of correctly answered TEL4 items in the US and Germany was used as the dependent variable. Independent variables were included at both the 1st level (person level) and the 2nd level (institution level).

Table 4. Results from Multi-Level Modelling.

Parameter	M0	M1	M2	M3	M4
Fixed effects					
Intercept	21.89 ***	21.84 ***	21.06 ***	21.99 ***	21.22 ***
Country (GER)		0.26	−0.28	0.62	0.16
Gender (male)			1.56 ***		1.55 ***
Interaction gender (male) * country (GER)			1.09 *		0.81
Primary language (other than national language)				−1.96 ***	−1.93 ***
Primary language (other than national language) * country (GER)				−1.67 *	−1.27
Random effect					
Var (institutional 2nd level) u_{0j}	32.23	32.22	31.87	31.87	31.51
Var (individual 1st level) r_{ij}	49.73	49.73	48.93	49.21	48.49
ICC	39.33%				
Deviation	31,045.18	31,045.08	30,973.49	30,997.97	30,933.06
AIC	31,051.18	31,053.08	30,985.49	31,009.97	30,949.06
BIC	31,070.41	31,078.73	31,023.96	31,048.44	31,000.36

Note. Level of significance: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

First, a variance component model was calculated (M0). This model is also referred to as a zero model and serves as a starting point for subsequent multi-level modelling (Hox 2010; Raudenbush and Bryk 2002). The zero model divided the variance in economic knowledge into variance between schools (2nd level residual variance) and variance within schools (1st level residual variance). The zero model contained only the intercept—21.89 TEL4 points—as a fixed parameter. This value corresponds to the average score achieved by the overall sample (students in the US and Germany) on the TEL4 (42 items). The deviance, Akaike Information Criterion (AIC) values and Bayesian Information Criterion (BIC) are global fit indices (Hilbe and Robinson 2013; Singer and Willett 2003), which served as benchmarks to evaluate the model improvements of the subsequent models (M1–M4) compared to the zero model. A reduction in the global fit values indicates a model improvement.

In models M1 to M4, the covariates (gender and language) were added stepwise to the multi-level models of the TEL4 scores.

In M1, the country (reference group Germany (GER)) was integrated in the model so that the intercept represented the mean score of students in the US and the country variable deviation of students in Germany. The country variable, therefore, was a dummy variable (0 = students in the US; 1 = students in Germany). Students in Germany were 0.26 TEL4 points above students in the US, but the country effect was not significant in M1 ($p = 0.76$) meaning there were no significant differences between students in the US and Germany (H1). Nevertheless, the country variable was retained in the following models to determine the interaction effects of language or gender with the country.

In M2, gender (reference group male) was included as an additional covariate. Compared to the zero model, deviance, AIC, and BIC in M2 decreased, whereby the reduction in deviance was significant according to a likelihood ratio test of the difference. This indicated an improvement in the model.

Likewise, an interaction effect between gender (male) and country (GER) was identified in M2. Without this interaction effect, the mean gender effect was calculated for students in the US and Germany, which would not allow for a country-specific analysis of the gender effect. The constant in M2 shows that female students in the US had a TEL4 score of 21.06 points. M2 predicted the lowest score for the sample of female students in Germany with 20.79 TEL4 points. In M2, the country variable (-0.28) was again not significant meaning although female students in Germany performed worse than students in the US in terms of their TEL4 score, this effect was not significant. However, the gender effect was significant for male students, that is, male students in both countries performed better than female students (H2.1/2.2) with the associated interaction effect ($p = 0.04$). In M2, an average advantage of 1.56 items was predicted for male students in the US. With 23.43 TEL4 points, male students in Germany performed best. The scores of male students in Germany were 0.81 points better than those of the comparison group in the US (22.62 TEL4 points). The interaction effect of country and gender showed that gender had a stronger effect on the score in Germany than in the US (H2.3).

In M3, primary language was included as a covariate (dummy variable). Compared to the zero model, the deviance, AIC, and BIC fit indices were lower in M3. The likelihood ratio test between M0 and M3 was significant, which indicated model improvement.

The constant represented in M3, that is, students in the US whose primary language was English, had a TEL4 score of 21.99 points. In M3, the country variable (0.62) was not significant, that is, students in the US did not differ significantly from students in Germany in terms of TEL4 score. However, the interaction effect between primary language (national language is not the primary language) and country (GER) showed that in addition to the significant negative effect (-1.96 points, $p = 0.00$) when the national language was not the student's primary language, there was an even more negative effect of -1.67 ($p = 0.04$) when the student was from Germany. The effect of primary language not corresponding to the national language was, therefore, stronger in Germany than in the US (H3.3). The significant interaction effect of country (GER) and primary language (non-national language) in M3

predicted a TEL score of 18.98 points for students in Germany whose primary language was not the national language (in this case German) (H3.1). Students in the US whose primary language was not English scored 20.03 points (H3.2).

Finally, in M4, all covariates were integrated into the overall model to test the effects. In M4, deviance, AIC, and BIC were lower, so an improvement in the model can be assumed. The model included gender (reference group male), the primary language (non-national language), and the corresponding respective interaction effects with the country (GER). The intercept of 21.22 TEL4 points represented female students in the US whose primary language was English, that is, the national language. In M4, the country variable (-0.16) was not significant, which (if the other parameters remained constant, that is, female students whose primary language was the national language) did not differ between countries in terms of TEL4 score. The gender effect for male students was significant, as was the effect for primary language, with roughly the same effect as in M2 and M3. However, the associated interaction effects, that is, when both country interaction effects were considered in the overall model, were non-significant (p language = 0.11 and p gender = 0.12). Nevertheless, hypotheses H2.3 and H3.3 cannot be rejected since M2 and M3 showed significant effects and a likelihood ratio test between M4 with and without interaction effects showed that although the reduction in divergence was only slight, (5.34) it still was significant ($p = 0.07$).

5. Conclusions

5.1. Discussion

As expected, no significant differences in economic knowledge were found between secondary school students in the US and Germany in this comparative study, and (H1) the assumed effects of gender and primary language were identified: male students in the US and Germany performed better on the TEL4 than female students (H2.1 and H2.2). Similarly, students whose primary language was not the national language performed worse on the TEL4 than students whose primary language was the national language (H3.1 and H3.2). The gender and language differences were more pronounced in Germany than in the US (H2.3 and H3.3). In prior research, various reasons for the gender gap have been discussed. In many studies, male students have shown greater interest in economic topics (Jensen and Owen 2001; Schumann and Eberle 2014), a connection between interest and media use has been found (Behrens et al. 2014; Förster and Happ 2019; Krapp and Ryan 2002), and factors of this kind have correlated to economic knowledge acquisition (Biewen et al. 2018; Förster and Happ 2019).

A further possible explanatory approach to the gender gap was provided through textbook analyses. A study conducted in the US revealed that women and men are unequally represented in introductory economic textbooks, where 90% of the examples of economists, business leaders, and policy makers are male (Stevenson and Zlotnik 2018). This research points out that gender-specific effects on the cognition of economic content and economic knowledge may stem from the gender perspective in textbooks and in economic education (Porter and Serra 2017). However, the extent to which such distortions influence students' economic understanding remains unknown and should be investigated in future research. In other studies women showed less self-confidence in economic knowledge and understanding (Arnold and Rowaan 2014; Owen 2012) and, therefore, are expected to perform poorly even before the test (Ballard and Johnson 2005); however, male students appeared to have much greater self-confidence in economic teaching and learning situations, which increased their advantage in gaining economic knowledge (Davies et al. 2005).

The focus of some studies has been the test format to explain the better performance of male test takers. Female test takers tend to perform worse on MC test formats (Ferber et al. 1983; Lumsden and Scott 1987). This was the case particularly when the MC test format was still relatively new for both genders and, therefore, test takers still had a low level of 'test wiseness' in this format. Davies et al. (2005) suggest that the MC test format provokes a different response behavior in men and women and, therefore, influences their

test performance. Men are bolder in the MC test format, that is, they are more likely to choose an answer than women. An indication for the confirmation of this assumption was shown by the fact that in interviews or written tests with an open-response format, the gender effect was evident to a lesser extent (Davies et al. 2005). In the secondary school sector in the US, tests in MC format are more widespread than in Germany, where tests with open-response formats are more frequently used in assessments (Lind 2009; Reusser 2009). This might be one possible explanation for a greater gender effect in Germany than in the US, which also is in line with our prior research with students from the higher education sector (Brückner et al. 2015).

Many approaches have been taken to explain language-related differences in economic knowledge and understanding. Generally, when a student's primary language is not the language of instruction, that student requires more cognitive capacities to comprehend the language as well as the content being presented (Chamot and O'Malley 1996; Yoshida 2010). Subject-specific vocabulary and expressions in economics (e.g., opportunity, costs, etc.) pose a particular challenge in this context (Alqahtani 2015), as they tend to reflect more abstract concepts that allow no or only a highly simplified visual representation. This creates a major hurdle for non-native speakers of the language of instruction (Yoshida 2010). Moreover, language often is associated with cultural norms and understandings. Having a primary language other than the language of instruction can lead to misinterpretation of a concept (van de Vijver and Pooringa 2004), comprehension problems, and incorrect use of specialized terminology.

Regarding language-related differences in students' performance on economics tests, our prior research identified distortions due to limited test fairness (Zlatkin-Troitschanskaia et al. 2019; Schlax et al. 2020). Developers of educational assessments generally orient themselves toward the national language in terms of subject-specific vocabulary, expected test processing time, and complexity of content. The increased difficulty and cognitive load, which may be caused by lower levels of language competence for non-native speakers, are seldom considered. For instance, a lack of knowledge of subject-specific terms may extend the time required to read, process, and solve test items, and it may increase the likelihood of making mistakes (Brückner et al. 2015; Schlax et al. 2020). Thus, differences in performance on economics tests among secondary school students regardless of their primary language may also be culturally related, as indicated in other studies (Oberrauch and Kaiser 2018; Parker 2006).

5.2. Limitations and Future Perspectives

The findings from this study should be viewed critically because of the following limitations. First, after integrating the two determinants—gender and primary language—high percentages of variance at the 1st level (student) and 2nd level (class) remained unexplained in the multi-level model. With these covariates, we took into consideration only two personal characteristics that currently are being discussed extensively in economic education in the US and Germany (Asarta et al. 2014; Bayer and Wilcox 2019; Brückner et al. 2015; Happ et al. 2016). The findings from this study highlight that these two determinants represent only a part of the individual and contextual characteristics that explain secondary students' economic knowledge. Therefore—considering the unexplained high level of variance at the 1st level and 2nd level—other structural and personal characteristics need to be researched. However, in the present study, no other characteristics are assessed in a comparable manner that can be included in the models. Other comparable characteristics that are expected to influence the acquisition of economic knowledge across countries should be explored in further studies.

Second, a considerable limitation in this study is the lack of representativeness of the samples, as described in Section 3. Therefore, the findings in this paper are not generalizable. Although the samples allowed us to estimate correlations between the two personal characteristics of gender and primary language, the findings may have been different with more representative samples for each nation investigated, for example, as a result of

curricular differences in economic education across federal states in the US and Germany (e.g., Baden-Wuerttemberg made significant curricular changes in economic education in 2016; [Oberrauch and Kaiser 2019](#)). In future research, samples should be drawn to include test takers from all federal states.

Related to this point is the great school-specific differences in economic knowledge found between students in both countries. The ICC illustrates that school-specific differences explain almost 40% of the variance in economic knowledge, that is, students' economic knowledge varied depending on the secondary school they were attending. Though school-specific differences can have different causes, one of the possible explanations may lie in the varying curricular standards within and between the US and the federal states of Germany. In the US, for example, only 25 of the 50 states have mandatory curricula for economics as a subject ([CEE 2022](#)). However, the students in the sample come from schools spread across several states. Thus, the school-specific differences found in the multilevel models at the institutional level could be caused by curricular differences, which must be considered in future studies with expanded samples at the student, class, and school levels.

Third, some limitations of the test instrument must be considered. In addition to a specific content-related focus on the CEE's 20 content standards, items on the TEL4 are in a closed-response format. According to prior research, it cannot be ruled out that the findings may change if students' economic understanding was assessed using other test formats, such as written essays. As discussed above, gender-related differences, as well as interaction effects with the country, may be explained by the specific test format used in this study and corresponding differences in students' level of wisdom in the test format ([Davies et al. 2005](#)).

Despite these limitations, the results of this comparative study shed light on some of the challenges the two industrialized Western nations may face in economic education. No significant differences were found in economic knowledge between students from both countries (H1). However, the mean value (see model M0) across all students from both countries is only slightly more than 21 points. This means that with a maximum of 42 possible points, the students solved only slightly more than half of the items correctly indicating deficits in economic knowledge despite curricular changes in both countries. This represents a cross-national challenge for economic education.

The state of research on comparative analyses between students in the US and Germany can be described as deficient. This study is only a first step toward counteracting this desideratum. As the results show, similar and different challenges can be identified for economic education in both countries. Thus, gender- and language-related differences in economic knowledge are present in both countries but are more pronounced in Germany than in the US. In the future, such comparative studies could be beneficial for both countries.

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Notes

- ¹ For reasons of data protection, we were not permitted to ask test takers about their country of origin (of the parents or the students) and their primary language together. Since the surveys were conducted in school classes, the country of origin in particular would have allowed identification of individuals in the class. Therefore, the focus in this article is language.
- ² Although versions A and B were developed at the same time, the test developers (Walstad et al. 2013) found only minor differences in measurement characteristics between version A and version B. Therefore, only data from version A from the US are analyzed in this paper.

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