



Biscriptuality as a Bridge to Biliteracy: The Development of Scriptual Skills in Reading and Writing in Russian as a Heritage Language in Germany

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ABSTRACT

Due to the specific context of language acquisition and language learning within a migration situation, students may have only restricted opportunities to acquire literacy (reading and writing) in their heritage language in institutional settings. Therefore, in migration contexts, students' literacy skills in different languages may follow different developmental paths resulting in various levels of reading and writing skills. While previous research has shown that the exposure to different scripts in biscriptual bilinguals may contribute to the heterogeneity of writing skills in a heritage language, the role of scriptual skills in constituting complex literacy profiles of both reading and writing remains to be clarified. Utilising Latent Transition Analysis, the present study investigates students' profiles of scriptual skills in reading and writing and the patterns of change within the profiles occurring over time. This study draws on the data of the German panel study "Multilingual Development: A Longitudinal Perspective" (MEZ). Overall, it analyzes the development of scriptual skills in Russian as a heritage language of 131 German-Russian bilinguals from the two cohorts (grade 7 and grade 9) over three waves. The results reveal different developmental patterns for scriptual skills in reading and writing of biscriptual bilinguals and suggest that the use of the Latin script may serve as the bridge to biscriptuality. Furthermore, the findings highlight the role of heritage language classes in the development of scriptual skills.

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In view of contemporary, rapidly changing requirements and conditions for successful social participation, the mastery of reading and writing skills is key to educational success and future career prosperity (European Commission/EACEA/Eurydice, 2016). In a migration context, the development of literacy skills may take place in more than one language (e.g., the majority language, foreign language/s learned at school, heritage language/s). Being a part of such complex multilingual repertoires, *heritage language* (HL) is defined as a language other than the majority language spoken by immigrants and their children (see Montrul, 2012, p. 170; Valdés, 2000). Literacy skills in an HL do not hamper the development of literacy skills in the majority language, according to Usanova and Schnoor (2021). Moreover, students' biliterate skills as cultural capital have a potential to be converted into economic capital and may positively influence bilingual's future earnings (Agirdag, 2014a; 2014b; Rumbaut, 2014). Thus, once developed, literacy skills in an HL have the potential to become a valuable resource contributing to future career prosperities of immigrant students. Considering the given institutional settings for majority language learning, students achieve the most prominent literacy skills in the majority language if compared to the other language/s in their repertoires (Usanova & Schnoor, 2021). In addition, literacy skills in an HL show high variability among bilinguals (Polinsky & Kagan, 2007). Due to the restricted opportunities to acquire literacy in an HL in a migration context, there is no single benchmark for the extent of biliterate skills but instead there are continua of competencies that may vary among the languages or specific skills (Dworin, 2006; Hornberger, 2003).

Most studies conducted on literacy skills in bilinguals focus either on writing or on reading, with only a few focusing on both skills (e.g., Brehmer & Mehlhorn, 2018; Brehmer et al., in press; Dworin, 2003; 2006; Klinger et al., 2019b; Sparrow et al., 2014). Studies conducted on writing in more than one language have shown that writing skills in different languages are positively interrelated (Schoonen et al., 2003; 2011; Soltero-González et al., 2012; Sparrow et al., 2014; Uluçam-Wegmann et al., 2019; Usanova, 2019; Usanova & Schnoor, 2021). The studies which considered both skills in bilingual students revealed that the acquisition sequence for both skills may deviate from typical monolingual sequences (Dworin, 2006). Dworin (2006) reports that bilinguals may even develop writing ability in the second language prior to oral abilities by applying their literacy skills in the majority language to literacy learning in the HL. Furthermore, reading and writing skills might follow different developmental paths (Dworin, 2003; 2006). The divergence in the development of both literacy skills in bilinguals is highlighted by the differences in the relation of each skill to the contextual factors as well as by the dynamics and instability of influences within the reading-writing relationship (Klinger et al., 2019a). Furthermore, the relationship between reading and writing skills differs between the majority language (ML) and HL: whereas the directionality of influences in the ML may come from reading to writing (receptive to productive), in HLs, the influence from writing to reading (productive to receptive) has been found (Klinger et al., 2019b). The reasons for these different developmental paths in reading and writing in bilinguals remain largely unexplored.

One of the possible influences on the differential development of both literacy skills in an HL may come from the settings in which the development of biliteracy skills takes place. Whereas the acquisition of literacy in the majority and foreign languages occurs predominantly in institutional settings, students' literacy in their HL often develops without any institutional support. In Germany, students may attend different forms of HL classes: organized by the federal states (taking place at schools), by consulates, or by private organizers (e.g., private courses in churches, communities, private associations) (Brehmer & Mehlhorn, 2018; Lengyel & Neumann, 2017). The number of schools that provide HL classes is rather low and unequally distributed among the German federal states (Brehmer & Mehlhorn, 2018, p. 261). Overall, HL classes are provided only in a limited number of languages. There is no systematic overview of the languages taught in HL classes in Germany, and the number of languages varies among the German federal states (Lengyel & Neumann, 2017). Furthermore, the content, methods, and qualification of teachers in HL classes vary extremely (Montanari et al., 2018, p. 220). Typically, students start to attend classes while already having some receptive and productive skills. However, students who attend the HL classes show a high variation in their proficiency levels, which is even higher in literacy skills (Montanari et al., 2018). Moreover, as Montanari et al. (2018) show, the continuity of the attendance of HL classes varies among students, and the dropouts may occur at any stage.

The research shows that HL instruction is beneficial for the development of biliteracy, and the quality of instruction is crucial (Sparrow et al., 2014). If attended, the HL classes may positively influence the development of literacy skills in bilinguals. However, the effect may vary for both literacy skills (i.e., reading and writing). The study on the effectiveness of the HL classes conducted by Brehmer and Mehlhorn (2018) reveals that HL classes fostered writing skills (both spelling and the length of produced texts) of German-Russian bilinguals at most if compared to the other proficiencies (e.g., listening, reading comprehension). Still, though the context of migration provides only limited opportunities for institutional support of the literacy skills in the HLs, students may manage to develop reading and writing skills in their HLs (Brehmer et al., in press; Brehmer & Mehlhorn, 2018; Böhmer, 2015).

Apart from contextual influence, the differences in the development of both literacy skills in an HL may be induced by settings where the acquisition of biliteracy involves not only different languages but also different scripts (e.g., Latin/Cyrillic in German-Russian bilinguals in Germany). Script represents the core of literacy which draws on the abilities of decoding and encoding written language (Alves et al., 2020, p. 2; Olson, 1999). Thus, scriptual skills represent a building block that is fundamental to both reading and writing literacy and allow for crossing the bridge between spoken and written modalities. Previous research on biscriptual bilinguals has shown that even without formal instruction in the HL, bilinguals are able to distinguish between different scripts and are aware of their differences (Kenner et al., 2004). If formal instruction is given, children may also experience possible cognitive benefits from the simultaneous learning of both scripts (Kenner et al., 2004).

To specify the biliteracy development in two scripts, the term *biscriptuality* has been used (Usanova, 2019). According to research on biscriptual writing, students' biscriptuality represents a continuum of scriptual skills, with two poles representing two different scripts (e.g., Latin and Cyrillic) with the mixing of both scripts placed between both poles. The *Continuum of Biscriptuality* framework proposes that biscriptual bilinguals, while developing their scriptual skills, apply different strategies in writing (intrascriptual vs. interscriptual graphemes' mixing, transliteration and transcription). According to this framework, students' biscriptuality is related to and provides insights into students' biliteracy. Thus, studies reveal that students' scriptual skills also reflect their writing skills in the HL, with students who write in Cyrillic script showing the highest skills in writing, followed by those who mix both scripts and those who compose texts by using the Latin script only (Usanova, 2016; 2019). Furthermore, this approach assumes that students' biscriptuality is dynamic, and the movement alongside the continuum of scriptual skills can take place in either direction (Usanova, 2019).

Thus far, biscriptuality has been primarily investigated with regard to writing. Less is known about biscriptuality as *complex* literacy profiles involving scriptual skills in reading and writing. Furthermore, whereas cross-sectional studies investigated instances of script choice or scriptual skills at a certain period, the development of scriptual skills from the longitudinal perspective remains to be explored. Previous cross-sectional research on biscriptual writing noted the dynamics across the continuum of biscriptual skills in a migration context with the development of scriptual skills potentially going in either direction (Usanova, 2019). However, a longitudinal study is needed to get insights into the actual process of moving across the *Continuum of Biscriptuality* as well as to determine the directions of such movement. The current study aims to explore the role of script in reading and writing in Russian as an HL in biscriptual German-Russian bilinguals and to contribute to the still rare research on developmental paths in both literacy skills in an HL of biscriptual bilinguals by answering the two research questions:

1. What profiles of scriptual skills in reading and writing exist in biscriptual German-Russian bilinguals as locations on the *Continuum of Biscriptuality*?
2. What patterns of change in scriptual profiles may occur over time?

METHODOLOGY

DATA

The current study draws on the data from the German panel study "Multilingual Development: A Longitudinal Perspective" (MEZ) (Gogolin et al., 2017), which was funded by the German Federal Ministry of Education and Research (BMBF). MEZ investigated individual and contextual conditions that influence multilingual skills in students of higher school-age. MEZ was a

longitudinal cohort-sequence study with two starting cohorts (grade 7 and grade 9 students) and with four waves of data collection over three years (2016 to 2018). The panel comprised more than 2,000 students from the German secondary educational system including students with Russian, Turkish, and monolingual German language backgrounds (Usanova & Schnoor, 2021). Only those students who had been in the German educational system from no later than the third grade were invited to participate in the study. The study design involved testing in several languages (English as the first, and French and Russian as the second foreign languages learned at school alongside with German as the majority language, and Russian or Turkish as HLs). To meet these requirements of the design, students' receptive and productive language skills were tested in these languages. Individual and contextual data were collected as well.

The current study analyzes the receptive and productive language data for the group of German-Russian bilinguals from three waves and from both starting cohorts. The average age of the students was 14.54 years ($SD = 1.2$). At the first wave, students were in the middle of grade 7 (first cohort grade 7) and the middle of grade 9 (second cohort grade 9). In the second wave, students were at the beginning of grade 8 (first cohort) and the beginning of grade 10 (second cohort). In the third wave, students were at the end of grade 8 (first cohort) and the end of grade 10 (second cohort). Only those students who participated in all three waves were included in the current study. The overall sample of German-Russian bilinguals included in the current study consisted of 131 students. The selected data comprise the written language data in Russian as well as the background data from student and parental questionnaires. Furthermore, data on students' cognitive ability were included into the analysis.

INSTRUMENTS AND SCORES

All students included in the current study carried out reading and writing tasks in HL Russian. The tasks were administered in schools. Students had six minutes for the reading speed and comprehension task and 30 minutes for the writing tasks (IEA Hamburg, 2017).

To test students' reading skills, a translated version of the German reading speed and comprehension test LGVT 5–12+ (Schneider et al., 2017) was used. This test consists of three parallel versions of fairytale texts distributed among three waves. Students were required to read a fairytale and fill in the gaps by choosing one of the four suggested test items. The score for reading comprehension was calculated based on the number of correctly chosen items. In case of a wrong solution, one point was deducted from the general score.

Furthermore, all students were pretested on their scriptual skills in Russian. They were required to read a short passage of a C-test and asked to fill in the gaps. This C-test, like a classical C-test, is based on the deletion of the second half of every third word. The reconstruction of the systematically deleted part of words in a text as given within a C-test may serve as an indicator for general language proficiency (Eckes & Grotjahn, 2006). Those students who could not read the text in Cyrillic had an option to mark the field, which stated, "I cannot read in Cyrillic script." Based on this pretest, students were divided into two groups, which got either the Cyrillic version of the reading test (those who managed the pretest) or the transcribed version of the same text (those who answered that they could not read in Cyrillic script). The transcription of the reading test was conducted based on the Duden conventions for the transcription of Russian into German. The choice of this system is based on previous research indicating that Latin graphemes used in writing by German-Russian bilinguals show high correspondence with Duden conventions (Usanova, 2019), as these are written with Latin graphemes and are primarily based on reproduction of the sound (Mulisch, 1996).

The writing prompt used in the study was developed by the FörMig study (Dirim & Döll, 2009). Since MEZ was designed as a panel study, the elaborated writing assignments parallel to the original FörMig prompt were used to measure students' writing skills over time and to avoid motivational as well as learning effects (Gogolin et al., in press; Klinger et al., 2019a). The writing tasks required students to write down a trial version of an article for a youth journal on the topics "How to make a gingerbread house" (first wave), "How to make string lights" (second wave), and "How to make a boomerang" (third wave). All writing tasks were developed based

on the same principles: they involved nine pictures and aimed at eliciting expository text types (Gogolin et al., in press). The writing tasks differed in their difficulty, with the easiest task used in the first wave, followed by the more difficult tasks in the second and the third wave, respectively (Schnoor, in press). We calculated a general score for writing based on five empirical indicators referring to the basic dimensions of language: a rating score for task accomplishment (textual-pragmatic dimension), types of verbs, nouns, adjectives, and conjunctions, and elements of academic language (lexico-syntactic dimension), and the number of words (productivity) (Gogolin et al., in press).

Those students who could not write in Cyrillic script were allowed to compose their texts using the Latin script. Based on the script chosen for writing (see [Table 1](#)), students were classified into the following groups: Latin (students who used the Latin script only), Cyrillic (students who used the Cyrillic script only), and Mix (students who mixed both Latin and Cyrillic scripts in writing, starting from at least three instances of script mixing within a text).

SCRIPT	WRITTEN TEXTS
Latin	Stolbi Pranišnij Domik zdeljat nadla nam: Wodw, Sabarnaja Pudru, i Tjesta. Samaja Peruaja sto mi budim deljat dat narisujim na kartoni nash domik it putom
Mix	Наша вода, Вода, Ног, Давка, Мука, Тесто, Ватикан, Бумага и Карадаси. Свацата берим Ног и режим Бумагу как Ата.
Cyrillic	Для изготовления пряничного домика тебе понадобится: тесто, вода, каташка, протвень, нонс, ножницы, линейка, гластиер, ложка, кондитер, картон а пудринный сахар. (накато ты должен

Table 1 Examples of the scripts chosen for writing in Russian. The instances of inserted Latin graphemes into Cyrillic script are marked with circles.

Since the current study focuses on students' scriptual skills in reading and writing in Russian as an HL, only the choice of script in reading and writing was considered for the current analyses. The general scores were not analyzed.

ANALYSIS

The current study investigated students' scriptual skills in reading and writing in Russian as an HL in German-Russian bilinguals. To identify the profiles of scriptual skills existing in the investigated population and to trace the patterns of changes in scriptual profiles over time, we conducted the *Latent Transition Analysis*, or LTA (Collins & Lanza, 2010). LTA is a special version of *Latent Class Analysis* (LCA) for longitudinal data (Goodman, 1974; Lazarsfeld & Henry, 1968; Vermunt & Magidson, 2009; Wolfe, 1970) and is a person-oriented statistical modeling approach to identifying unobserved subgroups of persons in the investigated population. This grouping is, per definition, unobserved but estimated as a categorical latent variable based on observed categorical indicator variables. Unlike in LCA, where these groups are called *classes*, these subgroups are called *statuses* in LTA to emphasize that participants' affiliation can change over time. For example, participants who only use the Latin script at time *t* could mix the alphabets at *t*+1 and use the Cyrillic script only at *t*+2.

We used two categorical variables as observed indicators for the estimation of the latent variable: "Script used in Russian reading (1 = Latin; 2 = Cyrillic)" and "Script used in Russian writing (1 = Latin; 2 = Mix; 3 = Cyrillic)". Both variables were measured at each of the three waves of data collection. The array of possible combinations of these two variables' categories

at three timepoints resulted in a contingency table with 216 cells. This contingency table served as the empirical data, which the LTA model was fitted to, in order to identify homogeneous subgroups of participants. Due to the *a priori* unknown number of subgroups in the population, we identified the best number of statuses to represent the empirical data by estimating a set of LTA models (2 to 5 statuses) and compared them by model fit indices, interpretability, and parsimony (Collins & Lanza, 2010; Nylund et al., 2007).

Since we used only two variables as indicators, we could not start with LCA models prior to LTA to determine the best fitting model at each wave separately, because our indicators did not provide enough empirical information to estimate cross-sectional models with more than one class. However, the contingency table for the longitudinal data contains enough cells ($W = 216$) for more complex models. **Table 2** shows the results for the models with one to five latent statuses.

NUMBER OF LATENT STATUSES	G^2	DF	AIC	BIC
1	471.62	206	1268.10	1293.98
2	133.54	204	934.02	965.64
3	85.46	192	909.94	976.07
4	not well identified			
5	not well identified			

Table 2 Model comparison
 ($n = 131$).
 Note: Bold entries reflect
 selected model.

The likelihood ratio statistic G^2 (Agresti, 1990) is an indicator for the absolute model fit. It reflects how well an LTA model fits the observed data (see Collins & Lanza, 2010, pp. 81ff.). Due to the sparseness of the data ($N/W < 5$), the G^2 statistic does not follow a χ^2 -distribution. Thus, the associated p -values were not reliable and are not reported (Köhler, 1986; Köhler & Larntz, 1980). Instead, we relied on evaluating indices for relative model fit. Relative fit indices allow comparing opposing models by their balance between model fit (i.e., accuracy) and parsimony. The Akaike Information Criterion (AIC, Akaike, 1987) suggested the model with three statuses, whereas the Bayesian Information Criterion (BIC, Schwartz, 1987) suggested the model with two statuses. The models with four or five statuses were not well identified in terms of the uniqueness of the maximum likelihood solution and the degree of the latent status separation. Besides the statistical indices of model evaluation, the interpretability of the results is key for model selection. Based on the theory on biscriptuality, we chose the three-status model because it allowed us to differentiate a *Mixed* status.

Also, due to the relatively small sample size ($n = 131$), we could not estimate separate models for our participants' starting cohorts to check if they were comparable. Instead, we examined whether there was equality of the cohorts' distribution before (concerning the indicator variables) and after (concerning status patterns) the model estimation. None of these tests showed significant scores under the null hypotheses of equality of the distribution. Thus, we analyzed the total sample of 131 participants in the three-status LTA model.

SAMPLE STATISTICS

Based on students' scriptual skills in reading and writing, students were assigned to groups with different levels of scriptual skills. Thus, students were divided into two groups for reading: those who read in Cyrillic script and those who read in Latin script (the Cyrillic and the Latin groups). Similarly, students were divided into three groups for writing: those who compose texts with Latin letters (Latin group), those who mix the Latin and the Cyrillic scripts in writing (Mix group), and those who apply the Cyrillic script (Cyrillic group).

Table 3 reveals the means and standard deviations for continuous variables and percentages for dichotomous variables for the overall sample ($n = 131$) as well as for the group's subsamples divided by *cohort*: grade 7 ($n = 65$) and grade 9 ($n = 66$), by *script used in reading*: Latin ($n = 36$) and Cyrillic ($n = 95$) as well as by *script used in writing*: Latin ($n = 56$), Mix ($n = 27$), and Cyrillic ($n = 48$). The codings of the variables are listed in the online appendix 1. The outcomes for all conducted comparisons are provided in the online appendix 2.

Table 3 Sample statistics (n = 131).
* p < .05; ** p < .01; *** p < .001

	COHORT				READING			WRITING		
	MISSING %	MEAN/% (SD)		P	MEAN/% (SD)		P	MEAN/% (SD)		P
		GRADE 7 (n = 65)	GRADE 9 (n = 66)		LATIN (n = 36)	CYRILLIC (n = 95)		LATIN (n = 56)	MIX (n = 27)	
Reading Russian t1	0.0	5.7 (10.3)	7.1 (9.7)		1.5 (4.1)	8.3 (10.9)	***	2.1 (3.8)	8.3 (12.4)	10.4 (11.5) ***
Writing Russian t1	0.0	26.4 (14.0)	30.7 (13.0)		22.3 (11.6)	31.0 (13.6)	**	23.8 (10.4)	29.2 (13.7)	33.9 (15.0) **
Grade 7 (%; ref. Grade 9)	0.0	–	–		61.1	45.3		51.8	51.9	45.8
Female (%; ref. Male)	0.0	70.8	75.8		63.9	76.8		67.9	77.8	77.1
Cognitive ability	6.1	16.9 (6.3)	18.3 (4.3)		17.4 (4.8)	17.8 (5.6)		17.4 (4.9)	16.2 (6.0)	18.8 (5.5)
School track: Gymnasium (%)	0.0	58.5	53.0		58.3	54.7		50.0	51.9	64.6
Migration background	9.9	1.8 (0.4)	1.7 (0.5)		1.8 (0.4)	1.7 (0.5)		1.8 (0.4)	1.6 (0.5)	1.8 (0.4)
Language acquisition	38.2	1.2 (0.7)	1.1 (0.5)		1.1 (0.6)	1.2 (0.6)		1.1 (0.5)	1.2 (0.7)	1.2 (0.7)
Heritage language classes in school (%)	4.6	23.0	29.7		5.7	34.4	**	10.9	26.9	45.5 **
Heritage language classes outside school (%)	4.6	14.8	15.6		5.7	18.9		9.1	11.5	25.0
Parents with high education (%)	38.9	78.0	74.4		73.9	77.2		81.1	66.7	76.0
Russian language used mostly in the family (%)	20.6	58.7	77.5	*	59.3	72.7		61.4	77.3	75.6

The students of grade 7 and grade 9 within our bilingual sample tend not to deviate regarding most of the investigated characteristics. Students from grade 9 perform better in reading ($M = 7.1$) compared to students from grade 7 ($M = 5.7$), but the difference is not significant ($t[129] = 1.83$, $p = .070$, $g = 0.32$). In writing, students from grade 9 also perform better ($M = 30.7$) than students from grade 7 ($M = 27.4$) but, similarly to the results for reading, this difference is not significant ($t[129] = 0.85$, $p = .40$, $g = 0.16$). The absence of significant differences between the grades regarding literacy skills in the HL is not surprising. Unlike literacy skills in the majority language, where we expect better-developed literacy skills in students of higher grades, literacy skills in the HLs are not necessarily better in students of higher grades compared to a younger group of students. Instead, literacy skills in the HLs may show higher variability within the grades. This variability in literacy skills is induced by rather restricted learning opportunities for the literacy skills in the HL given within the migration situation if compared to the literacy skills in the ML, which students develop based on systematical formal learning in school. Thus, depending on their learning experiences, students of both grades may develop rather similar literacy skills in the HL.

The only significant difference between the students from both grades was found regarding Russian language use within the family. Here, 58.7% of students from grade 7 tend to use Russian for the communication within the family, whereas 77.5% of students from grade 9 do so ($\chi^2[1] = 4.29$, $p = .04$, $\Phi = 0.04$). Overall, however, the given similarities between both cohorts regarding most of the investigated characteristics (**Table 3**) allow us to consider both cohorts jointly in the analysis of scriptual skills conducted within the current study.

SCRIPTUAL GROUPS IN READING AND WRITING

Table 3 shows that scriptual groups deviate regarding their reading and writing skills. Thus, students who read in Cyrillic script achieve significantly better results in reading comprehension ($M = 8.3$) and writing ($M = 31.0$) in Russian compared to students reading the Russian task in the Latin script ($M = 1.5$ in reading comprehension; $M = 21.3$ in writing): $t[121] = 1.47$, $p < .001$, $g = 0.72$. Students who write in Cyrillic also perform best in reading comprehension ($M = 10.4$), followed by students who mix both scripts in writing ($M = 8.3$) and those who write in Latin script only ($M = 2.1$): $F[2, 128] = 11.01$, $p < .001$, $\eta^2 = 0.38$. Similarly, students who write in Cyrillic perform better in writing ($M = 33.9$) compared to students who mix both scripts in writing ($M = 29.2$), and those who write with Latin script only ($M = 23.8$): $F[2, 128] = 8.00$, $p = .001$, $\eta^2 = 0.33$.

Concerning the additional variables, no significant differences were found between most of the investigated variables and the script used both in reading and writing (**Table 3**). Noteworthy, the German-Russian bilinguals who read in Cyrillic are more likely to attend HL classes offered within the school: 34.4% of those who read in Cyrillic reported attending HL classes inside school, whereas only 5.7% of the German-Russian bilinguals who read in Latin do so ($\chi^2 [1] = 10.71$, $p = .001$, $\Phi = 0.29$). Similarly, a difference in the attendance of the HL classes exists among the scriptual groups in writing. Thus, the largest share of students attending HL classes in school was found among those who write in Cyrillic (45.5%), followed by the Mix (26.9%), and the Latin (10.9%) groups ($\chi^2[2] = 15.02$, $p = .001$, $\text{Cramer-V} = 0.35$). Furthermore, a small share of participants within each of the scriptual groups indicated attending HL classes both inside and outside of school: those who read in Latin (2.8%, $n = 1$), read in Cyrillic (4.2%, $n = 4$), write in Latin (1.8%, $n = 1$), mix both scripts in writing (3.7%, $n = 1$), and write in Cyrillic (6.25%, $n = 3$).

RESULTS

Our LTA model of scriptual skills in Russian as an HL revealed three statuses of biscriptuality at three waves of data collection: *Latin*, *Mixed*, and *Cyrillic*. These groups evolved over time by participants switching statuses. Bilinguals in the Latin status had a high probability of using the Latin script for reading (64%) and writing (94%) in Russian. The bilinguals in the Mixed status were characterized by a high probability of using the Cyrillic script in reading (98%) and mixing both scripts in writing (97%). Bilinguals in the Cyrillic status were characterized by a high probability of using the Cyrillic script in reading (97%) and writing (87%).

In LTA, three parameters are essential for interpretation: item-response probabilities, latent status prevalences, and transition probabilities (Collins & Lanza 2010, p. 39 ff., p. 187 ff.). **Table 4** shows the parameter estimates on a probability scale, ranging from 0 (impossible) to 1 (certain), representing an event's likelihood to occur. For the readers' convenience, we report these probabilities in percent. The item-response probabilities represent the possibility associated with the indicators' categories and conditional membership in a particular latent status. These parameters are the key measures in an LTA because they characterize the found profiles and allow setting the latent statuses' meaning. To ensure that this meaning stays the same over time, the item-response probabilities are constraint to be equal at each wave (measurement invariance). Overall, the item-response probabilities in our study clearly separated the latent statuses' meanings, which is a crucial factor of the models' quality.

	STATUS 1 ("LATIN")	STATUS 2 ("MIXED")	STATUS 3 ("CYRILLIC")
1) Item-response probabilities			
Reading			
- Latin	.64	.02	.03
- Cyrillic	.36	.98	.97
Writing			
- Latin	.94	.03	.03
- Mix	.06	.97	.10
- Cyrillic	.00	.00	.87
2) Latent Status prevalences			
Wave 1	.44 (n = 58)	.19 (n = 25)	.37 (n = 48)
Wave 2	.37 (n = 48)	.04 (n = 6)	.59 (n = 77)
Wave 3	.37 (n = 49)	.42 (n = 55)	.21 (n = 27)
3) Transition probabilities			
From status in wave 1 ...	... to status in wave 2		
	Latin	Mixed	Cyrillic
Latin	.85	.05	.10
Mixed	.00	.16	.84
Cyrillic	.00	.00	1.00
From status in wave 2 ...	... to status in wave 3		
	Latin	Mixed	Cyrillic
Latin	1.00	.00	.00
Mixed	.24	.37	.39
Cyrillic	.00	.63	.37

Table 4 Three-latent status model of biscriptuality in Russian at three waves of data collection (n = 131).

To trace the change in the bilinguals' membership in the found statuses over time, latent status prevalences were analyzed. Latent status prevalences are the estimated probabilities of the latent variables' categories (latent statuses) at each time point. In other words, they represent the estimated group size of the statuses at any point in time. In the first wave, *Latin* was the most prevalent status, containing 44% of the sample, followed by *Cyrillic* (37%) and *Mixed* (19%) statuses. This distribution, however, changed in the second wave, where *Cyrillic* became the most prevalent status (59%), followed by *Latin* status (37%). In contrast, *Mixed* status (4%) was unlikely in the second wave. In the third wave, the picture changed again, and *Mixed* (42%) became the most prevalent status, followed by *Latin* (37%) and *Cyrillic* (21%) statuses. These changes in the latent status prevalences indicate that biscriptuality is not a stable phenomenon and that (some) participants are likely to change their status over time.

In a further step, we investigated which groups were more likely to change their status over time. *Transition probabilities presented in Table 4* reveal the participants' possibilities to transit to a latent status at t+1 conditional on their status membership at t. Thus, in our study, transition probabilities express the likelihood of specific patterns of change in scriptual development in Russian across three waves. There are always t-1 transition probability matrices estimated in

an LTA model. **Table 4** shows two transition probability matrices estimated in our study. The first matrix contains the conditional transition probabilities from the first to the second wave. Members of *Latin* had a high probability to stay in their status (85%) and a low probability to transit into either *Mixed* (5%) or *Cyrillic* (10%) statuses in the second wave. Besides, *Latin* is the only status to which there is a 0% probability for the transition from other statuses in the second wave. Members of *Mixed*, in turn, have a low probability (16%) of remaining in their status and a high probability (84%) of transition to *Cyrillic* in the second wave. Members of *Cyrillic*, instead, do not show any change from the first to the second wave. The probability of staying in *Cyrillic* is estimated as the highest (100%). The second matrix contains the conditional transition probabilities from the second to the third wave. The members of *Latin* now have the highest probability of staying in their status (100%) in the third wave. The members of *Mixed*, on the other hand, have a high probability of changing their status (63%) in the third wave. They had a probability of 39% of changing their status to *Cyrillic* and a probability of 24% of changing their status to *Latin*. Members of *Cyrillic* also had a probability of 63% of changing their status to *Mixed* in the third wave.

CONCLUSION

The current study analyzed the development of scriptual skills in reading and writing in Russian as an HL in biscriptual German-Russian adolescents. The *Continuum of Biscriptuality* (Usanova, 2019) was applied as a theoretical framework. According to this theoretical approach, students' biscriptuality represents a continuum of scriptual skills. This framework proposes that biscriptuality is a dynamic phenomenon and that students change their location alongside the continuum in either direction when developing their scriptual skills. Our study aimed to empirically verify this theoretical approach by answering the two research questions: (1) What profiles of scriptual skills in reading and writing exist in biscriptual German-Russian bilinguals as locations on the Continuum of Biscriptuality? (2) What patterns of change in scriptual profiles may occur over time? We conducted *Latent Transition Analysis (LTA)* to identify subgroups of scriptual skills in the investigated population of German-Russian biscriptual bilinguals. In LTA, such subgroups are called *statuses* to emphasize that participants' affiliation may change over time, i.e., their location on the Continuum of Biscriptuality may change.

We found that the model with three statuses of scriptual skills in Russian as an HL provided the best fit. The *Latin* status members had relatively high probability (68%) of using the Latin script for reading and high probability of applying the Latin script for writing in Russian (94%). Members of the *Mixed* status had high probabilities of using the Cyrillic script for reading (98% probability) and mixing both scripts when writing (97%). Members of the *Cyrillic* status had high probabilities of using the Cyrillic script for reading and writing (97% and 87%, respectively). These findings support the Continuum of Biscriptuality and show that the bilinguals' scriptual skills are not evenly distributed across the continuum but cluster at specific locations with two different scripts marking the poles of the continuum and the *Mixed* status placed between the poles.

Furthermore, our study contributes to this theoretical framework by providing empirical findings on the *balance* of scriptual skills in reading and writing within the found statuses. The findings show a general tendency of scriptual skills in reading and writing to overlap at both poles of the continuum (*Latin* and *Cyrillic* statuses), and to diverge at the space between the poles (as given within the *Mixed* status). The found convergence and divergence of scriptual skills in reading and writing in different scriptual groups reflect the acquisition order of both literacy skills with receptive skills (reading) preceding productive skills (writing) as shown by the previous research (e.g., Ahmed & Wagner, 2020). These findings also support the research on biliteracy showing a diversity of pathways for developing literacy profiles of reading and writing skills (Dworin, 2003; 2006).

In the second research question, we addressed the patterns of change in scriptual profiles in reading and writing in biscriptual adolescents over time. *Latent status prevalences* indicated that different statuses took the leading position in each of the three waves. *Latin* (44%) was the most prevalent status in the first wave. In the second wave, *Cyrillic* (59%) status dominated. In the third wave, the picture changed again, and *Mixed* (42%) took the leading position. These

changes in status prevalences show that scriptual skills are not static and students' biscriptuality represents a dynamic phenomenon as proposed by the Continuum of Biscriptuality (Usanova, 2019).

Interestingly, the found profiles deviated in their *transition probabilities* for the change of the status. Thus, the transition matrices suggested different transition patterns for different statuses at different time points. The members of *Latin* had the highest probability to stay in their status, whereas the *Mixed* group had the highest probabilities of changing their status across the three waves. In the *Cyrillic* group, different tendencies could be observed: the stability in status was given in the second wave and the fluctuation in the third wave. These results indicate the movement across the Continuum of Biscriptuality to be prevalent among the *Cyrillic* and the *Mixed* groups. The findings also reveal the general movements *towards* biscriptuality, as shown by the change of the status from *Mixed* to *Cyrillic* in the second wave. These results highlight the role of applying different scripts as a bridge to biliteracy in biscriptual bilinguals (Al-Azami et al., 2010; Brehmer & Usanova, 2017; Usanova, 2019). However, remarkable *bidirectionality* in the changes of statuses in writing in the *Cyrillic* and *Mixed* groups was also observed in the current study. The theoretical framework of biscriptuality suggests that the movement alongside the Continuum of Biscriptuality may take place in *either* direction. The empirical findings of our study confirm this theoretical assumption and reveal that scriptual skills in an HL may be a subject of change if considered from the developmental perspective. The drawback from *Cyrillic* to *Mixed* status between the second and the third waves reflects the vulnerability of literacy skills within the migration situation reported by previous research. Overall, students' scriptual skills in reading turned out to be more stable than students' scriptual skills in writing, showing fewer dynamics across three waves.

Our study did not aim at clarifying the reasons for the given change in scriptual profiles. However, two aspects should be considered for the clarification of the found dynamics in the change of statuses.

First, the movement on the Continuum of Biscriptuality may be subject to the change in the test situation, and scriptual skills might be vulnerable to the difference in the task difficulty. In our study, the writing prompt used in the third wave was more difficult than the prompts used in the first two waves (Schnoor, in press), which might have influenced the change in the application of script in writing and so that the prevalence of the *Mixed* status as well as high transition probabilities from the *Cyrillic* to *Mixed* in the third wave. Studies have shown scripts and orthographies of both languages being simultaneously activated in different-script bilinguals (Mishra & Singh, 2014; Moon & Jiang, 2012), so that the choice of scriptual resources for writing is always there and may provide the solutions when biscriptual bilinguals experience difficulties with the writing of certain graphemes. Thus, biscriptual bilinguals have the opportunity to use the scriptual resources of both languages and transfer the graphemes from one language to fulfill the task with a higher level of difficulty.

Second, the minor movement from the *Latin* group towards both other groups in the second wave and the absence of the movement in this group in the third wave indicate that external resources, such as formal language learning, are needed for the development of scriptual skills to take place. Previous research has shown a positive trajectory towards biliteracy in bilingual children participating in a biliteracy program (Sparrow et al., 2014) and those attending HL classes (Brehmer & Mehlhorn, 2018). In line with previous research (Brehmer & Mehlhorn, 2018), the results of the current study revealed a significant association between students' scriptual skills in reading and writing and the attendance of the HL classes inside of school. This finding highlights the importance of HL classes as being a crucial source for the development of biliteracy within a migration situation. However, the results of our study also show the tendency for HL courses to be not the sole factor determining the acquisition of literacy skills in the HLs in the context of migration since less than 50% of those who read and those who wrote in Cyrillic script attended the HL classes. Therefore, further studies should clarify which resources students use to develop their literacy in HLs and which settings substitute institutional learning within a migration situation while promoting the development of literacy skills in HLs. These resources may be crucial for launching the status change from the *Latin* via *Mixed* to the *Cyrillic* group fostering the positive trajectories of biscriptuality and biliteracy.

The additional files for this article can be found as follows:

- **Online Appendix 1.** Biscrptuality as a bridge to biliteracy. DOI: <https://doi.org/10.16993/jhlr.40.s1>
- **Online Appendix 2.** Biscrptuality as a bridge to biliteracy. DOI: <https://doi.org/10.16993/jhlr.40.s2>

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COMPETING INTERESTS

The authors have no competing interests to declare.

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