Preparing teachers for multilingual classrooms: competence development in pre- and in-service teacher education in Austria

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Abstract

The increasing number of multilingual students in schools demands teachers with competence in linguistically responsive teaching. Over the past decade, opportunities to learn (OTL) to acquire the competence have been implemented in pre- and in-service teacher education programs in Austria. The aim of this study was to assess how effectively primary school teacher education programs in Austria prepare pre- and in-service teachers to support the language and subject-related learning of their future multilingual students. Using the DaZKom test, the development of competence regarding linguistically responsive teaching (LRT) as well as beliefs regarding multilingualism in school were examined in different groups of pre- and in-service teachers over time. Additionally, the study analyzed the interaction of OTL focused on linguistically responsive teaching, beliefs on multilingualism in school and linguistically responsive teaching competence. The results show that these OTL have a positive effect both on LRT competence as well as beliefs. The effect sizes correspond with the intensity of the OTL, indicating that more comprehensive OTL have a greater impact. The study also demonstrates that OTL, together with students' initial beliefs and LRT competence, are predictors of the observed learning outcomes. Based on these findings, we conclude that the availability of comprehensive OTL as part of teacher education programs is essential to support multilingual students in schools. Furthermore, the results suggest that OTL should be designed in a way that accommodates students with diverse learning prerequisites.

Keywords: Linguistically responsive teaching, effectiveness of teacher education programs, teacher competence, opportunities to learn (OTL)

Introduction

In Austria, as in Germany and Switzerland, linguistic heterogeneity is the norm in schools. In the school year 2023/24 more than 26% of all pupils in Austria reported a language other than German as their everyday language[1], with the percentage rising to over 30% in primary and lower secondary education (Statistik Austria, 2024, Table 5). International comparative studies such as PISA and the results of national assessments have repeatedly shown that pupils whose first language is not German tend to achieve lower academic outcomes compared

[1]The German term used in the statistics is "im Alltag gebrauchte Sprache(n)" (language(s) used in everyday life). The count included students who, according to the school statistics, indicated a language other than German as the first language used in everyday life, irrespective of whether German is also indicated as another language used in everyday life.

to their monolingual peers (Haider & Lindemann, 2023). While family background — especially socioeconomic status — plays a critical role in shaping educational success in Austria, research indicates that disparities in student performance persist even when controlling for these socioeconomic factors (Haider & Lindemann, 2023, p. 80). As early as 2010, the OECD report on migration and schools in Austria (Nusche, Shewbridge & Rasmussen, 2010) stated that teacher education and training play a central role in addressing linguistic diversity in educational institutions since teachers need specific competence to support students with different language learning backgrounds in their educational process.

The so-called 'PädagogInnenbildung Neu' [2] (henceforth PBN) represents a milestone in Austrian education policy with regard to the inclusion of such specific competence in teacher education programs. For the first time, it was legally stipulated that all teacher education curricula should consider competence development with respect to multilingualism and German as a second language as well as sensitivity to different language registers in various contexts, such as academic language use or subject-specific discourse. The aim of PBN was to equip future teachers with the necessary competence to effectively support pupils from diverse linguistic backgrounds. This includes fostering linguistically responsive teaching (LRT) competence, which enables educators to create inclusive learning environments, adapt instructional strategies to students' linguistic needs, and promote equitable access to education.

LRT competence encompasses a specific body of knowledge and skills that equip teachers to effectively teach in a linguistically responsive manner (Lucas & Villegas, 2011). Teachers must not only acquire linguistic knowledge but also reflect on their beliefs and develop the ability to assess language in their classrooms.

In the context of PBN, LRT competence should be embedded in the compulsory part of teacher education for all students. Furthermore, there was the possibility of setting up optional subject-specific specializations. In the primary school teacher education program, which is the focus of this article, the majority of Austrian University Colleges of Teacher Education (“Pädagogische Hochschulen”, henceforth PH) have set up such an optional specialization, usually amounting to 60 ECTS credits. These specializations are designed with a focus on the thematic expertise and subject-specific priorities of each PH institution, reflecting the diversity of educational approaches across different PH locations. Comprehensive competence models such as DaZKom (Ehmke et al., 2018) were not yet available at the time. The competence profile DaZKompP (BMB, 2025), that now serves as a basis for the design of new curricula in Austria, was also only developed subsequently to meet the need for a more structured description of the field.

[2]This roughly translates as: „Educator education new“.

As only a small proportion of students[3] take advantage of the opportunity to receive in-depth training in LRT as part of their initial teacher education, and as LRT competence have only been implemented in the compulsory part of primary school teacher education programs to a limited extent and not very systematically (Boeckmann & Schrammel, 2022; Schrammel-Leber et al., 2019), specialized in-service training courses continue to play an essential role in the qualification of teachers in LRT. With the obligation for teachers who teach in specific formats to support children with German as a second language to have a qualification (BMB, 2016), the role of in-service training programs as an essential area of quality development was further strengthened. The scope and content of in-service training programs at Austrian University Colleges of Teacher Education vary greatly, with LRT-related so-called „Hochschullehrgänge“ (university college courses) ranging from 6 ECTS credits to 30 ECTS credits (Boeckmann & Dannerer, 2024, p. 240f.).

In the above described context, over the last decade various programs have been set up to provide teachers with specific competence for the professional support of multilingual pupils in Austria. So far, however, there have been no studies on the effectiveness of these programs, i.e. how well they actually prepare (future) teachers for the challenges of everyday school life. A collaborative research project between the University Colleges of Teacher Education in Styria, Tyrol and Vorarlberg investigated the development of students' LRT competence after participating in different qualification programs. The aim of the project was to generate empirically validated data as the basis for future revisions of existing teacher education curricula. In this research project, the DaZKom test (Ehmke et al., 2018) was used for the first time on a large scale in Austria with support from Leuphana University Lüneburg. In addition to examining the development of LRT competence, the study also investigated how the beliefs of (future) teachers regarding LRT evolve over time. This article reports on selected results from this project and compares them with the DaZKom norm sample.

Theoretical Framework

The DaZKom model and test instrument

Over a decade ago, there was lack of empirically grounded standards for pre-service teacher education regarding the competence required in the field of linguistically responsive teaching to effectively support (second) language learners in mainstream classrooms. At that time, the focus was especially on second language learners / German as a second language. The DaZKom project was seeking to address this gap by providing both a theoretical framework in the form of a competence model for pre-service teachers of all subjects and a test instrument to measure (pre-service) teachers’ LRT competence. The competence model consists of three dimensions: *subject-specific registers*, *multilingualism*, and *didactics* which

[3]Surveys at the University Colleges of Teacher Education involved in this study have shown that, on average, 10% (University College of Teacher Education Styria), 8% (University College of Teacher Education Tyrol) and 20% (University College of Teacher Education Vorarlberg) of primary school teacher education students at the individual locations have chosen the LRT specialization offered.

are subdivided into different facets. The model further outlines three competence stages, drawing on the first three levels of the Five-Stage Model of Adult Skill Acquisition by Dreyfus & Dreyfus (1986). To empirically assess pre-service teachers' LRT competence, a paper-and-pencil test was created based on the model and administered to a large sample of pre-service teachers. Additionally, the model underwent content validation by a group of experts from the fields of German as a second language and educational science (Carlson et al., 2018).

Curriculum content in the light of the DaZKom model

In the context of the use of the DaZKom test for students enrolled in primary school education at Austrian University Colleges of Teacher Education, the question arises to which extent these students are prepared for the LRT competence delineated by the DaZKom model during their teacher education program. To answer this question, we conducted a content analysis to compare the Bachelor's degree curriculum of the PH Styria – the program which the majority of students in the sample are attending – with the DaZKom model. The results of this analysis are reported in this sub-chapter.

The content and competence descriptions of the compulsory part of the LRT-related Bachelor's degree curriculum for primary school teachers focus in particular on the dimensions *multilingualism* and *didactics* of the DaZKom model, rather than *subject-specific register*. The following section presents some examples of competence descriptions from LRT-related courses that are mandatory for all pre-service students and correspond to the sub-dimensions of the DaZKom dimensions *multilingualism* and *didactics*.

- *Second language acquisition:* "Second language acquisition and language development (with particular reference to academic language): have basic knowledge of important forms, phases and processes involved in language acquisition and development in the context of multilingualism" (EVSO, 2019, p. 56 and 58) [4] ; "know the differences between conversational language, language used in a subject-specific context and academic language and have the ability to perceive and stimulate linguistic development in this regard" (EVSO, 2019, p. 84)
- *Migration*: "can promote subject-specific language learning in the context of multilingualism (German as a second language or other languages brought along [by pupils])" (EVSO, 2019, p. 84)
- *Diagnosis*: "assessment and correction" (EVSO, 2019, p. 56)
- *Language promotion*: "know the basic principles of LRT-related didactics and the main methodological approaches to LRT, with the ability to promote the development of communicative and linguistic skills in a targeted way" (EVSO, 2019, p. 68); "know and are able to apply LRT (scaffolding) methods in the subject area" (EVSO, 2019, p. 84).

[4] All examples of competence descriptions are from EVSO (2019) originally in German, translated by the authors.

The dimension *subject-specific register* is not specifically addressed, nor are the grammatical structures and vocabulary sub-dimension or the semiotic systems sub-dimension. Since all graduates of the Bachelor's degree program are qualified to teach German as a subject, one would assume that these sub-dimensions are included in other more general parts of the curriculum. However, the analysis of the entire 175-page curriculum proves this assumption wrong. References to grammar and vocabulary can be found in only four more instances, the terms "morphology", "semantics", "lexicon" or "syntax" are totally absent in the curriculum, and "text linguistics" is mentioned only once in the context of analyzing literature for children and young adults. Although the topic of *forms of representation* of the DaZKom sub-dimension *semiotic systems* is not explicitly mentioned, it can be assumed that it is addressed in the context of teaching skills for language-sensitive teaching and integrated language learning, as indicated by the following competence description: "know various didactic concepts and models for linguistic and multilingual promotion in the sense of integrated language learning [or]... suitable materials and strategies for language-sensitive teaching" (EVSO, 2019, p. 136).

In addition to the compulsory LRT-related courses, there is also an optional in-depth specialization on LRT at the University College of Teacher Education Styria called "Language education and diversity". It is noteworthy that similar to the compulsory part of the curriculum, the DaZKom dimension *subject-specific register* is also quite underdeveloped in the specialization. There is only one competence description dedicated to the DaZKom sub-dimension *grammatical structures and vocabulary*. However, this competence description is also connected to the dimension *didactics*, more specifically the sub-dimension *language promotion*: „can use didactic approaches for learning vocabulary, grammar and spelling in a targeted manner" (EVSO, 2019, p. 132). With respect to the other (sub-)dimensions of the DaZKom model, *multilingualism* and *didactics*, the specialization contains advanced skills as the following examples show: "have an understanding of the progression in the acquisition of German as a second language" (EVSO, 2019, p. 131); "know that linguistic-cultural heterogeneity is the norm in pluralistic societies" (EVSO, 2019, p. 131); "can document and interpret the results of language diagnostic procedures" (EVSO, 2019, p. 132); "develop personalized approaches for language promotion based on language diagnostic procedures" (EVSO, 2019, p. 135). Furthermore, the specialization contains manifold skills that go beyond mere language promotion, but involve the reflection of beliefs and are crucial to LRT, such as: "can critically reflect on their own attitudes and behavior in relation to discrimination by training their perception and practicing a change of perspective, and know strategies for initiating a change of attitude if necessary" (EVSO, 2019, p. 132).

To summarize, the curriculum analysis shows that students at the PH Styria are primarily trained in the DaZKom dimensions *multilingualism* and *didactics* during their teacher education program, with graduates of the LRT specialization gaining in-depth training in these dimensions. The dimension *subject-specific register*, on the other hand, is 'underexposed' in both the compulsory part of the Bachelor's degree program as well as in the specialization.

LRT-related Opportunities to Learn (OTL)

Academic OTL are essential for the development of professional competence as different studies have reported. They highlight the need for research on OTL that considers the quantity of OTL and their impact on teachers' competence (Osterberg et al., 2018, Kunter et al., 2011). As we already described in the introduction, LRT-related OTL are being implemented into primary school teacher education programs in Austria. However, there have been no studies on the effectiveness of these programs. The first investigation into this aspect was carried out by a collaborative research group at the University Colleges of Teacher Education in Styria, Tyrol and Vorarlberg with support from Leuphana University Lüneburg which is reported here. Similar studies in Germany have shown that specific LRT-related OTL in university teacher training contribute to increased competence among pre-service teachers. Schroedler and Stangen (2019) evaluated a blended learning course on language education in content teaching at the University of Hamburg in a pre-post-design, using the DaZKom test. The course takes place parallel with the core practicum and the subject-specific didactics seminars pre-service teachers have to attend. The analyses of the OTL, based on data from the full Hamburg cohort, show that nearly all topics of the OTL scale (Ehmke & Lemmrich, 2018) they used are significantly positively associated with the level of LRT competence achieved. In the context of efforts to improve teacher education they concluded that these OTL should receive curricular attention (Schroedler & Stangen, 2019). While they found significantly increased LRT-competence after the semester, more than half of the students did not even reach "minimum standard" (according to the standards in Gültekin-Karakoc et al., 2018) (Stangen et al., 2020). To examine the extent to which the recorded OTL predict gains in LRT competence, they used a regression model that showed that language-related thematic OTL had the strongest influence (Stangen et al., 2020). Lemmrich et al. (2024) investigated a study across nine German universities using the DaZKom test to evaluate OTL. Results show that especially specific LTR-related topics that are addressed during pre-service teacher training predict pre-service teachers' LRT competence. Regarding helpful LRT-related activities, particularly analyzing authentic classroom interactions and developing individual language support plans were predictive actions for competence acquisition. A study evaluating OTL in pre-service teacher training at three universities in Berlin, which used the DaZKom test (Darsow et al., 2019), found significant competence development for students on both the Bachelor's and Master's programs. The results show that students studying German or a foreign language, as well as those attending a primary school teacher education program, performed better in the pre-test, suggesting that these groups of students have an advantage in terms of prior knowledge. While two of these groups achieved better results than students of other subjects in the post-test, those studying a foreign language did not benefit as much from their prior knowledge in terms of competence gain. Based on these results, Darsow et al. (2019) suggest that the design of LRT-related OTL should take into account the different learning prerequisites of students. Berkel-Otto et al. (2020) conducted a study investigating

the impact of an in-service teacher education program on the LRT competence and beliefs of two groups of teachers, using the DaZKom-test. The study also examined teacher satisfaction with the in-service training program using qualitative data. The results show that the program has a significant impact on the LRT competence and beliefs of the overall sample. Comparing the results of the two groups, it is evident that while one group exhibits significant changes in both LRT competence and beliefs, the other group does not. This is an interesting result, given that both groups were offered the same OTL by the same university teachers. The authors of the study suggest that possible factors influencing the results include different motivations for attending the in-service training course, participants' work backgrounds, and conditions for exchange among participants. Compared to the standards for the DaZKom norm sample as reported in Gültekin-Karakoç et al. (2018), 90% of participants in the study by Berkel-Otto et al. (2020) were below the “minimum standard” at the initial measurement. After attending the OTL 20% of the participants achieved the “minimum standard” and 12.5% achieved the “regular standard”.

With respect to beliefs previous studies have shown that LRT-related OTL had a positive effect on the change of beliefs of pre-service teachers on multilingualism – especially if OTL content was closely related to the content of the measuring scales. Some other factors besides LRT-related OTL also had positive correlations with belief changes, according to the studies. These included multilingualism, female gender, studying a language subject and attending a primary school teacher education program (Fischer & Lahmann, 2020; Kardel et al., 2024, Schroedler et al., 2023; Schroedler & Fischer, 2020).

Research questions

As mentioned above, previous studies using longitudinal date have shown that LRT-related OTL have a significant impact both on LRT competence and beliefs of pre- and in-service teachers. This study aims to explore if these effects can also be found in the LRT-related OTL that have been implemented in teacher education programs in Austria in recent years. In light of potential future changes in the curricula of the current study programs, the focus of this study is on comparing the impact of LRT-related specializations and LRT-related OTL in the compulsory part of the study programs. The sample groups of this study are chosen accordingly to make the comparison possible. The study also aims to find out which levels of LRT competence students have at entering and leaving their study programs by comparing the results to the DaZKom norm sample. Furthermore, the study intends to investigate the predictive power of LRT competence, LRT-related OTL, and LRT-related beliefs over time. Accordingly, the following research questions were addressed in this study:

1. How do LRT competence, LRT-related learning opportunities (OTL) during university teacher education (LG1 = LRT-related OTL topics; LG2 = LRT-related OTL activities) and LRT-related beliefs change over time in different subgroups and in the full sample?
2. To what extent can the results regarding the LRT competence in this study be connected and compared to the findings of the DaZKom norm sample?

3. How are pre- and in-service teachers' LRT competence and their beliefs regarding multilingualism in school related to LRT-related OTL during their studies?
4. To what extent do LRT competence, LRT-related OTL, and LRT-related beliefs at the first measurement point influence the development of LRT competence and LRT-related beliefs at the second measurement point?

Methodology

Sample

The sample consists of several groups of students[5] on primary school teacher education programs at four Austrian University Colleges of Teacher Education. Apart from one group of Master's students, all participants were engaged in the pursuit of a Bachelor's degree. Furthermore, the study incorporated participants from an in-service teacher education program, specifically the university college course “German as a Second Language” at the University College of Teacher Education Styria (PHSt; Group D). The majority of participants in Group D are teachers already working in schools. The groups of students in pre-service teacher education include one full-year cohort each from PH Vorarlberg (PHV; Group A) and PH Styria (PHSt; Group C) as well as two groups of students who completed in-depth training in LRT by choosing the specialization 'German and Multilingualism' at PH Tyrol (PHT; Group E) or the specialization 'Language Education and Diversity' at PH Styria (PHSt; Group F). Master's students participated in the “Specialization in German as a foreign language” program at the University College of Teacher Education Styria (PHSt; Group B).

The time interval between measurement point 1 and measurement point 2 is eight semesters for Groups A and C, six semesters for Group F and four semesters for Groups E and D. For Group B, the time interval is two semesters.

The majority of participants are female and have German as their first language. In the groups of students in pre-service training (Groups A, B, C, E, F), the participants are on average between 20.7 and 24.3 years old. In contrast, the group of in-service teachers (Group D) is on average 33.8 years old. With the exception of a small proportion of Group D, who work at lower secondary level, all participants are training to become primary school teachers or teach at primary school level.

Table 1 gives an overview of the sample groups, the extent of the respective qualification programs as well as further characteristics of the sample. Table 1 shows that the two groups

[5]The German Research Foundation (DFG) states that a study requires ethical approval whenever the participants (1) must endure high emotional or physical strains, (2) cannot be fully informed about the purpose of the study, and/or (3) are patients, who undergo functional magnetic resonance imaging or transcranial magnetic stimulation during the course of the study (https://www.dfg.de/foerderung/faq/geistes_sozialwissenschaften/). Our study did not affect any of these conditions and therefore did not require ethical approval. However, the participants signed a declaration of consent that contained information about the purpose of our study, handling and processing of data, and data protection. Owing to the sensitive nature of the questions asked in this study, survey respondents were assured that raw data would remain confidential and would not be shared.

D and E only have a small number of cases (< 15 students). Nevertheless, we have taken these groups into account, as this is a field experiment and this is the natural group size.

Table 1. Overview of the sample

Group	Description	N	ECTS	Male	Female	School Level Primary	School Level Secondary I	First Language German	Age
Group A	Full-year cohort (Bachelor) PHV	36	5	13.9	86.1	100.0	0.0	94.1	20.7
Group B	Specialization (Master) PHSt	15	8	0.0	100.0	100.0	0.0	93.3	24.3
Group C	Full-year cohort (Bachelor) PHST	64	9	23.8	76.2	100.0	0.0	88.3	21.8
Group D	Course (in-service) PHST	11	30	18.2	81.8	90.9	9.1	81.8	33.8
Group E	Specialization (Bachelor) PHT	9	60	11.1	88.9	100.0	0.0	88.9	22.0
Group F	Specialization (Bachelor) PHSt	19	60	15.8	84.2	100.0	0.0	89.5	22.1
Full Sample		154		17.0	83.0	99.4	0.6	89.9	22.8

Independent variables

Independent variables in this study are participants' OTL, and participants' beliefs regarding multilingualism in school. All questionnaires were presented in a multiple-choice format. The scales of LRT-relevant OTLs contained LRT-relevant topics (e.g. linguistics and scaffolding) that might have already been addressed in participants' coursework/training (16 items, α = 0,88), and LRT-relevant actions the participants might have taken before their pre- or in-service teacher education (8 items, α = 0.80) (Ehmke & Lemmrich, 2018). The items were designed based on the three dimensions of the structural model for LRT-competence and its sub-dimensions, including subject-specific register (topics are for example: areas of linguistics or differences between oral and written language), multilingualism (e.g. phenomena of second language acquisition), and didactics (e.g. support of the language learning process through scaffolding). The scale with LRT-relevant actions included activities such as "analyzing examples of the concrete language acquisition of learners with German as a second language". Respondents answered the following questions: "To what extent have the following

areas/actions been addressed throughout your teacher education program to date?" using a five-point Likert scale (0: not at all to 4: in several courses).

To assess the participants' LRT-related beliefs, we used validated scales with good psychometric quality that were developed in the context of the DaZKom-project (Hammer et al., 2018). The questionnaire includes 51 items (α = 0.86) on the aspects: (1) embracing the interconnected nature of language with culture and identity (2) valuing multilingualism (3) understanding language demand in content classrooms and (4) feeling responsible for language teaching. Responses were given on a four-point Likert scale (0: do not agree at all to 3: agree completely).

Dependent variable

The impact of the independent variables was assessed on the participants' LRT competence, measured by the DaZKom test. The conception of the instrument follows the structural model for LRT competence (DaZKom model; Köker et al., 2015, Carlson et al., 2018) and was extensively validated. In all studies conducted with the DaZKom-test, results reveal that OTLs play a major role in acquiring LRT competence (Lemmrich et al., 2024). The abbreviated test version in this study included 47 items across nine task units and took about 60 minutes to complete. The items were assigned to three subscales that corresponded to the dimensions of the model: subject-specific register (17 items), multilingualism (15 items), and didactics (15 items). Each item includes an authentic stimulus such as classroom interactions or math textbook tasks, paired with a corresponding task. Responses are given in one of three formats: open (12 items), semi-open (11 items), or closed (24 items). The test had an overall WLE reliability of α = 0.75. Further details on the test instrument and item construction can be found in Ehmke & Hammer (2018).

Findings

Research question 1: *How do LRT competence, LRT-related OTL during university teacher education (LG1 = LRT-related OTL topics; LG2 = LRT-related OTL activities) and LRT-related beliefs change over time in different groups and in the full sample?*

To answer the first research question, we conducted a mean comparison between the measurement time points for the individual groups and the full sample (table 2). At the second measurement point, students in the sample show, on average, a highly significant increase in LRT-relevant OTL (OTL topics: d = 1.43, OTL activities: d = 1.62), LRT competence (d = 0.77), and LRT-related beliefs (d = 0.61), across all groups as well as for the full sample. Concerning the subgroups, the highest increase on the four constructs can be found for Group E and Group F. These groups have the most increase on LRT-related OTL (Group E: OTL topics: d = 1.99, OLT activities: d = 2.97; Group F: OTL topics: d = 2.37, OLT activities: d = 4.00) and these results go together with the highest increase in LRT competence (Group E: d = 1.29, Group F: d = 1.52), and LRT-related beliefs (Group E: d = 0.88, Group F: d = 0.96) compared to other groups. In the other groups, however, the increases in the four constructs are smaller, but in most cases statistically significant, with moderate or large effect sizes.

Table 2. Statistical indicators at the first and second measurement point for LRT-relevant OTL (topics and activities), LRT competence, and LRT-related beliefs, differentiated by groups.

		T1		T2		Difference			
Group	Constructs	M	SD	M	SD	M	SD	p	Cohen's d
Group A	LRT-OTL Topics	1.73	0.70	3.26	0.56	1.52	0.78	0.000*	1.96
	LRT-OTL Activities	0.54	0.42	2.65	0.87	2.12	0.99	0.000*	2.13
	LRT competence	-0.46	0.67	0.31	0.43	0.77	0.67	0.000*	1.16
	Beliefs	2.08	0.23	2.23	0.34	0.15	0.29	0.004*	0.51
Group B	LRT-OTL Topics	2.64	0.61	3.31	0.45	0.67	0.58	0.000*	1.16
	LRT-OTL Activities	1.76	0.64	3.06	0.72	1.30	0.79	0.000*	1.64
	LRT competence	0.07	0.50	0.36	0.42	0.29	0.45	0.027	0.64
	Beliefs	2.28	0.23	2.33	0.10	0.05	0.24	0.410	0.22
Group C	LRT-OTL Topics	1.85	0.71	2.89	0.74	1.04	0.91	0.000*	1.14
	LRT-OTL Activities	0.90	0.80	2.27	0.85	1.37	1.06	0.000*	1.30
	LRT competence	-0.12	0.51	0.13	0.48	0.25	0.57	0.001*	0.43
	Beliefs	2.08	0.28	2.29	0.30	0.21	0.31	0.000*	0.68
Group D	LRT-OTL Topics	0.91	0.45	2.00	0.86	1.09	0.80	0.002*	1.37
	LRT-OTL Activities	0.40	0.36	1.58	1.11	1.18	1.09	0.008*	1.08
	LRT competence	-0.49	0.37	-0.13	0.50	0.37	0.55	0.049	0.67
	Beliefs	2.15	0.20	2.20	0.29	0.05	0.25	0.546	0.19
Group E	LRT-OTL Topics	1.97	0.75	3.35	0.48	1.38	0.69	0.000*	1.99

	LRT-OTL Activities	1.15	0.70	3.01	0.62	1.86	0.63	0.000*	2.97
	LRT competence	0.00	0.47	0.85	0.37	0.85	0.66	0.005*	1.29
	Beliefs	2.16	0.32	2.44	0.24	0.27	0.31	0.030	0.88
Group F	LRT-OTL Topics	1.97	0.56	3.33	0.58	1.36	0.58	0.000*	2.37
	LRT-OTL Activities	0.59	0.32	3.13	0.58	2.54	0.63	0.000*	4.00
	LRT competence	0.02	0.44	0.84	0.65	0.82	0.54	0.000*	1.52
	Beliefs	2.15	0.25	2.44	0.27	0.29	0.30	0.001*	0.96
Full sample	LRT-OTL Topics	1.86	0.75	3.04	0.72	1.18	0.83	0.000*	1.43
	LRT-OTL Activities	0.84	0.72	2.54	0.91	1.70	1.05	0.000*	1.62
	LRT competence	0.30	0.56	-0.18	0.56	0.49	0.63	0.000*	0.77
	Beliefs	2.12	0.26	2.30	0.30	0.18	0.30	0.000*	0.61

Note: Groups B, D and E comprise 15 or fewer people. The statistical parameters are therefore less accurate than the parameters of the other groups due to the small sample and the associated larger confidence intervals.

Research question 2: *To what extent can the results regarding the LRT competence in this study be connected and compared to the findings of the DaZKom norm sample?*

The DaZKom test instrument was developed as part of the BMBF project "DaZKom" (Ehmke et al., 2018). The test was used as part of a norm sample to test the psychometric quality of the test instrument (Ehmke & Hammer, 2018). In addition, a standard setting procedure was carried out with experts to obtain critical reference values as comparative values for future studies (Gültekin-Karakoc et al., 2018).

In the DaZKom norm sample, the test persons achieved an average LRT competence of M = 0.0 (SD = 0.63) scale values (Ehmke & Hammer, 2018). In relation to the DaZKom standard setting, the following results were obtained (Gültekin-Karakoc et al., 2018): 91.3 % of the students in the norm sample (N = 1383) are classified at the "below minimum standard" level, i.e. they do not have the minimum level of LRT competence required to be expected to be able to interact with students in a way that promotes learning. A proportion of 7.2% of the students surveyed in the sample achieved the "minimum standard" and can be considered LRT-

sensitive. Students at this level have the necessary minimum level of LRT competence to recognize linguistic disadvantages of multilingual pupils in subject lessons and to react to them in a didactically limited way. Only around 1.5% of student teachers reached the "regular standard" level, referred to here as students informed about LRT. They can analyze classroom interactions, student texts and materials in subject lessons and are familiar with language-promoting didactic options.

In comparison, 97.4% of the students in this study achieved a level of LRT competence corresponding to below the "minimum standard" at the first measurement point. However, this proportion was significantly reduced over the course of the respective teacher education programs the students attended. The proportion of students at the "minimum standard" level increased over time from 2.6 % to 13.0 %. At the second measurement point, 2.6 % of students even reached the highest level of "regular standard". Overall, it can be seen that the distribution of competence at the second measurement point is higher in this sample than in the DaZKom norm sample.

Table 3. Levels of LRT competence in the DaZKom norm sample (Gültekin-Karakoc et al., 2018) and in the present study

LRT Competence Levels / Labels	Description	Results DaZKom norm sample	Results T1	Results T2
Regular standard / "informed students"	e.g. knows language support elements, can analyze classroom interactions, student productions, teaching and learning materials.	1.5%	0.0%	2.6%
Minimum standard (students who are sensitized)	e.g. knows the connection between linguistic and subject-related learning, has selective LRT knowledge, has initial ideas on LRT support.	7.2%	2.6%	13.0%
Below minimum standard (non-specific approach)	e.g. realizes the role of language in learning unspecifically, has basic linguistic knowledge, realizes the distinction between oral and written language.	91.3%	97.4%	84.4%

Research questions 3 and 4: *How are pre- and in-service teachers' LRT competence, and their beliefs regarding multilingualism in school related to LRT-related OTL during their studies? To what extent do LRT competence, LRT-related OTL, and LRT-related beliefs at the first measurement point influence the development of LRT competence and LRT-related beliefs at the second measurement point?*

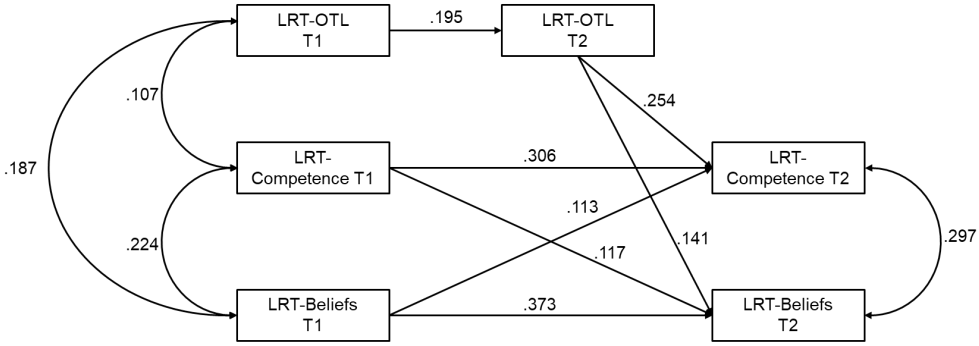

Figure 1. Path model predicting LRT competence and LRT-related beliefs by LRT-related OTL.

Figure 1 shows the results of a path analysis in which questions 3 and 4 are investigated. The findings generally show a statistically significant correlation between LRT competence, LRT-related beliefs and LRT-related OTL.

The analysis reveals significant relationships between pre- an in-service teachers' linguistically responsive teaching (LRT) competence and their LRT-related beliefs (LRT beliefs) at both measurement points (T1 and T2). The regression coefficients between these variables indicate that higher competence leads to more positive beliefs. The LRT relevant OTL (LRT-OTL) serve as a significant predictor of these beliefs, which means that the quality of the LRT-OTL has an impact on students' beliefs.

The influence of LRT competence, LRT-related beliefs and LRT-OTL on the results at T2 make it clear that LRT competence as well as LRT-related beliefs and LRT-OTL at T1 are significant predictors of the development of LRT competence and LRT-related beliefs at T2. Particularly noteworthy is the strong influence of the LRT-related beliefs in T1 on the LRT-related beliefs in T2 (beta = .373), which indicates a high stability of the beliefs. In addition, the path coefficients between the variables show that frequent LRT-OTL promote the development of students' skills and beliefs.

In summary, it can be said that higher initial LRT competence and positive LRT-related beliefs contribute significantly to the development and improvement of these competence and beliefs during the course of study. The LRT-OTL act both directly and indirectly as a significant influencing factor for the development of LRT competence and LRT-related beliefs over time.

Discussion and conclusions

This article examines the development of LRT competence and beliefs among pre- and in-service teachers over time, analyzing the impact of different OTL on their competence acquisition and beliefs.

For all groups in the sample, a significant increase in LRT competence could be demonstrated. This suggests that all students benefited from the OTL in their respective teacher education programs concerning their LRT competence. In the full cohorts without in-depth OTL in the

field of LRT (Groups A & C), lower effect sizes in LRT competence were observed compared to the groups that had access to additional LRT-relevant OTL (Groups E & F). Especially the comparison between Group C, which only completed the compulsory LRT-related OTL at PH Styria and Group F, which attended the additional OTL in the LRT-related specialization at the same institution, indicates that the more extensive LRT-related specialization had a stronger impact on LRT competence. The effect sizes in the groups that were offered intensive but shorter OTL - mostly alternating with teaching practice in schools (Groups B & D) - are also quite substantial and even exceed those of one of the two full cohorts, which were surveyed at the beginning and end of their entire teacher education program.

The results also show that students have a very low level of LRT competence at the beginning of their teacher education program, with over 97% below the “minimum standard”. After participating in OTL, 13% reach the minimum level of competence, and 2.6% reach the highest level of competence, the “regular standard”. These 2.6% all belong to the groups with more extensive OTL (Groups E and F). Although we can observe a significant increase in LRT competence for all groups, 84.4% of the sample group do not reach the “minimum standard” competence level by the end of their respective teacher education program.

To summarize, our study shows that all OTL included in the study have a significant effect on the increase of LRT competence of the pre- and in-service teachers. The more intense LRT-related OT have a greater impact on competence development. Despite the positive development of LRT competence over time, the study also shows, that the majority of the pre- and in-service teachers in the sample are still not equipped with the competence necessary to promote the language and subject related learning of their (future) multilingual students at the end of their respective teacher education programs. Our study thus shows similar results as previous studies on the development of LRT competence over time (Schroedler & Stangen, 2019, Stangen et al., 2020).

The study also demonstrates that the OTL analyzed have a positive influence on students' beliefs. The sample groups demonstrate a lower degree of divergence in terms of beliefs than in terms of LRT competence. Consequently, it can be concluded that the compulsory part of the teacher education programs also exerts a positive influence on students' beliefs. One potential explanation for this could be that beliefs are addressed in various OTL within pre- and in-service teacher education, including those that are not exclusively dedicated to the field of LRT. The positive impact of OTL on beliefs is in line with previous studies (Fischer & Lahmann, 2020; Kardel et al., 2024, Schroedler et al., 2023; Schroedler & Fischer, 2020). However, due to the small sample sizes additional variables that could also have an impact on the development of beliefs were not taken into account in this study.

Our study goes beyond the current state of research by using our path model to analyze the interaction of LRT-related OTL, LRT-related beliefs and LRT competence over time. The mutually statistically significant predictors show that OTL, but also students' learning prerequisites (their beliefs and their LRT competence) interact. The results also show that

students with better starting positions also achieve higher learning gains. As previously proposed (Darsow et al., 2019), these findings suggest that OTL should be designed didactically and methodologically in a way that allows students with different learning prerequisites to benefit from them optimally. Differentiation, which is often demanded in school teaching, should at best also be considered in university teaching.

A limitation of our study is that we were not able to take into account potential other factors, such as academic background or personal features that might have influenced LRT-related beliefs and LRT competence over time. Another limitation is the fact that, while the LRT-related OTL in the sample groups were similar with respect to quantity, they differed in content since the study included several University Colleges of Teacher Education in Austria.

The findings of this study highlight the need for comprehensive OTL for pre-service teachers to develop specific competence for effectively managing linguistic heterogeneity in the classroom. While the OTL in the compulsory part of the study program seem to provide an initial awareness of the issue and also exert a positive effect on students' beliefs, the results demonstrate that specializations, i.e. much more comprehensive OTL, have a much greater effect on learning gains. Consequently, such specific, exhaustive possibilities for specialization in the field of LRT should definitely be provided in future teacher education programs in Austria. However, it is equally important to consider LRT-related OTL within the compulsory component of teacher education programs, given the fact that so far to date only a limited number of students opt to specialize in this field. Taking into account the limited space reserved for LRT-related OTL in the compulsory part of current teacher education programs in Austria, aspects of LRT should be included in the didactics of all subjects. This would, on the one hand, increase the overall range of OTL for all students, on the other hand, it would emphasize that the responsibility for language promotion lies with all subjects and all teachers.

Future research should extend the present study to pre-service teachers for secondary education and in-service teacher education. The latter, in particular, remains highly demanded by teachers in Austria. However, with the exception of Group D in this study, there have been no studies on the effectiveness of these programs in Austria to date. Given the great variety of offers of LRT-related OTL for in-service teachers in Austria more empirical evidence on their effectiveness could help to develop more accurate OTL. As already suggested by the study by Berkel-Otto et al. (2020), further research in this field should also investigate which factors influence how effective LRT-related OTL are on the development of competence and beliefs.

Conflict of interest

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