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Research Article

Multilingualism as a Learning Resource in Map-Based Geography Lessons

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Abstract: Multilingualism, including foreign and heritage language repertoires, is omnipresent in classrooms across educational levels and societies. How-ever, there is a lack of existing geography education approaches that allow students to use their language repertoires as a learning resource to ensure an in-depth understanding and participation. As maps are inherently geographical, and gaining map skills plays a pivotal role in geography education, an explorative qualitative research design was developed concerning a multilingual map-based approach. Upper secondary students (n = 20), six of whom had a heritage language different from the target language, at a high school in North Rhine-Westphalia completed a multilingual task and evaluated it. The results of the qualitative study provide initial evidence of multilingual map-based education settings in geography education. This approach allowed students to use their language repertoires as a learning resource, and learners with differing heritage languages performed equally well as their peers in correctly implementing map-related words in their written texts. However, this approach did not encourage the use of lexically complex map-related words. Students' perspectives on the approach were included, although they were brief and limited. Still, the responses reflected a range of perceived benefits and challenges. The pedagogical implications of the results for teaching practice are elaborated upon at the end of the paper.

Keywords: multilingualism; geography education; map-based task; explorative qualitative design

Highlights:

- Conceptualizing multilingualism as a learning resource in a map-based geography education context.
- Innovative qualitative research design regarding integrating multilingualism in geography education.
- Pedagogical implications of the present study to empower teachers to integrate multilingualism.

1. Introduction

Students in geography classrooms across various education levels are heterogeneous in terms of ethnic, cultural, and socioeconomic backgrounds and possess differing foreign and heritage language repertoires (Kersting et al., 2024; Salloum et al., 2020). Language repertoires refer to the complete set of languages, dialects, and language resources that an individual or community can draw upon in various contexts (García & Wei, 2014). These language repertoires increasingly shape classrooms and are spoken at different proficiency levels (Gogolin, 2021; Prediger & Redder, 2020; Seah & Silver, 2020). Thus, multilingualism is omnipresent in every geography classroom. Moreover, in the subject of geography, academic and geographical language have unique characteristics and demands. Teachers use academic and geographical language to teach the subject, and learners need to acquire these language skills to access geographical knowledge and facilitate geographical learning (Brown & Ryoo, 2008; Gallagher & Leahy, 2019; Schleppegrell, 2004). Accessing geographical content is not just a cognitive task but also a language task, as it involves decoding (reading) maps, describing their spatial representations, and effectively communicating them through language (Heidari et al., 2024). The academic and geographical language used in the classroom is more complex than the everyday language that students speak outside of school (Schleppegrell, 2004; Snow & Uccelli, 2009; Spires et al., 2018). For instance, the use of geographical compounds, such as *urban sprawl* or map-related terms (e.g., *word scale*), represents higher language demands. This requires a degree of linguistic proficiency—the ability to understand and use language in different ways, depending on the geographical context and function (Becker-Mrotzek et al., 2023). Therefore, it can be assumed that language skills, particularly the use of geographical language, are also a basic prerequisite for participating in geography lessons, accessing the geographical content of human-environment relations, and encouraging communication (Heidari et al., 2022; Heuzeroth & Budke, 2020; Wey & Schubert, 2023).

In the United States and European countries, such as Germany, the number of second language learners has increased over the past ten years (Becker-Mrotzek et al., 2023; Irwin et al., 2022; Karlsson et al., 2020). Democratic schooling aims to sustain the inclusion of all students in educational achievements and success regardless of their background and linguistic proficiency within the classroom to counteract stigmatization and exclusion (Gay, 2002; Ladson-Billings, 2006; Paris, 2012). This would contribute to educational and, social justice in a democratic society. In

particular, language in content-area education, such as geography education, enables the acquisition of knowledge and further fosters class participation, as well as meaning and narrative creation (Kelly et al., 2021; Repplinger & Budke, 2018). Within geography education, this becomes particularly relevant when considering the development of *powerful geographical knowledge*, which includes the ability to understand complex human-environment relationships beyond the local scale (de Miguel González, 2024; Young, 2008). To ensure that all students—regardless of their language proficiency—can access and express *powerful geographical knowledge*, equitable language approaches must be implemented in geography education (Mitchell et al., 2022; Young, 2008). A major prerequisite for achieving this may include the integration of diverse language repertoires of students (Brown, 2006; Schleppegrell, 2004). This is crucial, as these repertoires bring enormous cognitive potential for geographical thinking (Rawling, 2022) and as learning resources that are not yet effectively utilized in the classroom (Cook, 1992; Karlsson et al., 2020).

However, in the current geography education discourse, there is a gap concerning the explicit consideration of multilingual students in research on language in geography (Heidari et al., 2024). This enforces the notion of a monolingual habitus–deeply ingrained attitudes, thought patterns, and behaviors characterized by the exclusive use and expectation of a single language, typically the institutionalized, dominant language of a societal context (Gogolin, 2021)–which contributes to bias in geography education practice and its research (Kelly et al., 2021). However, a large number of studies confirm the beneficial effects of explicitly including multilingual approaches on learning (Charamba, 2020; Gogolin, 2021; Heuzeroth & Budke, 2020; Usanova et al., 2023). Learning geographical methods, such as map skills, plays a pivotal role in understanding the representation of spatial aspects of human-environment relationships and is therefore inherently geographical. Consequently, acquiring map skills is an essential component of geography education (Gersmehl, 2024; Kimerling et al., 2016). However, there is a lack of concrete evidence regarding approaches to integrating multilingualism and the respective language repertoires of students as learning resources when using maps in geography education.

Therefore, the overarching aim of the present study is to research *how different language repertoires can be used as learning resources to access spatial information in map-based tasks.* To address the overarching aim, an explorative qualitative research design was developed and applied at the upper secondary level (ISCED III) at a high school in North Rhine-Westphalia. Twenty upper secondary students, six of whom speak a heritage language different from the target language German, completed a multilingual task and evaluated it. The results of the present qualitative study will provide evidence of multilingual map-based education settings in geography education. As little is known about students' views on integrating multilingualism into geography education, this study also provides valuable insights. The study explored participants' views on multilingualism, including its benefits, as well as the challenges of integrating language repertoires into geography education. The pedagogical implications of the findings for future teaching practices are presented at the end of the paper.

2. Theoretical Framework

2.1 Multilingualism in geography education

Language forms the foundation for teaching and learning in geography and is a dynamic construct that constantly changes and adapts to changing educational and differing contexts and requirements (Becker-Mrotzek et al., 2023; Brown & Ryoo, 2008). Therefore, the concept of appropriate language use is dynamic and closely tied to its contextual functions. In heterogeneous societies, such as the United States and Germany, classrooms are characterized by linguistic, ethnic, cultural, and socioeconomic heterogeneity, resulting in a variety of language repertoires possessed by students (Gogolin, 2021; Irwin et al., 2022). Generally, a basic distinction can be made between learners with multilingual backgrounds who speak less prestigious heritage languages[1] (Skrandies, 2020), such as Arabic or Russian, and monolingual learners who acquire multilingual skills through higher-prestige foreign language lessons in English, French, and/or Spanish at school (Usanova et al., 2023). Thus, learners' language repertoires and proficiencies are linked to their cultural origins, linguistic socialization, and innate language acquisition abilities. Various levels of proficiency and knowledge of language repertoires shape the multilingualism of students within a classroom, making multilingualism increasingly the rule rather than the exception (Gogolin, 2021). To reduce bias in the classroom, the language repertoires that students possess should be viewed as learning resources to draw upon, rather than being separated into minority languages (Charamba, 2020; Taketa, 1996). Thus, we adhere to Haukås et al. (2021) definition of multilingualism as "dynamic and integrated knowledge and/or use of more than one language or language variety" (p. 84).

2.2 Multilingual language in geography education

"Multilingual languaging" is an approach that takes the variety and heterogeneity of the language repertoires of students into account. It represents a dynamic and complex interplay of strategic and conscious integration of various language resources (e.g., heritage languages) within classroom discourse (Prediger & Redder, 2020). This goes beyond the mere use of different languages as in code-switching or bilingualism; it involves a deeper level of cognitive processing needed for geographical thinking (Rawling, 2022), where different language repertoires are used as learning resources and employed to acquire a more in-depth understanding of geographical concepts and meanings (Karlsson et al., 2020) related to human-environment relations concerning the development of *powerful geographical knowledge*. By eliminating language barriers, allowing for free language repertoire choice, and avoiding the obligation to communicate in a challenging educational language (target language), the scope of communicative actions is increased. This enhances interactions in the classroom, as well as the level of learning-related activation, thus intensifying the communicative problem-solving process (Auer, 2009; Prediger et al., 2019). Through the use of code-mixing—the lexical and syntactic merging of different languages (Auer, 2016)—and code-switching—the change of language while retaining lexical and syntactic structures (Auer & Eastman, 2010)—students can draw on different language repertoires and activate their broader mental lexicon. In cooperative learning settings, this can reduce linguistic complexity in problem-solving processes and support the acquisition of geographical language related to maps and their meanings in geography classrooms (Bär, 2009; Roche, 2018; Jessner, 2016). Lexical retrieval is supported through the activation and expansion of the mental lexicon. Students' skills in understanding relations between, for example, map-related words and their concepts are said to increase (Karlsson et al., 2020). This approach includes and acknowledges the variety of language repertoires that students possess and how they embed them in the classroom. The integration of language repertoires as resources is believed to empower students to participate more

[1] The prestige of a language depends on contextual factors such as its status, recognition in the target culture, labor market value, and how its speakers are perceived (Skrandies 2020, p. 361)

actively (Karlsson et al., 2020). This is embedded first to access content knowledge, providing the basis for acquiring a more complex written language mode to effectively communicate in diverse contexts. It is important to note, however, that this approach may require speakers of the same linguistic backgrounds in collaborative education settings (Prediger & Redder, 2020).

2.3 Students' Views on Multilingualism

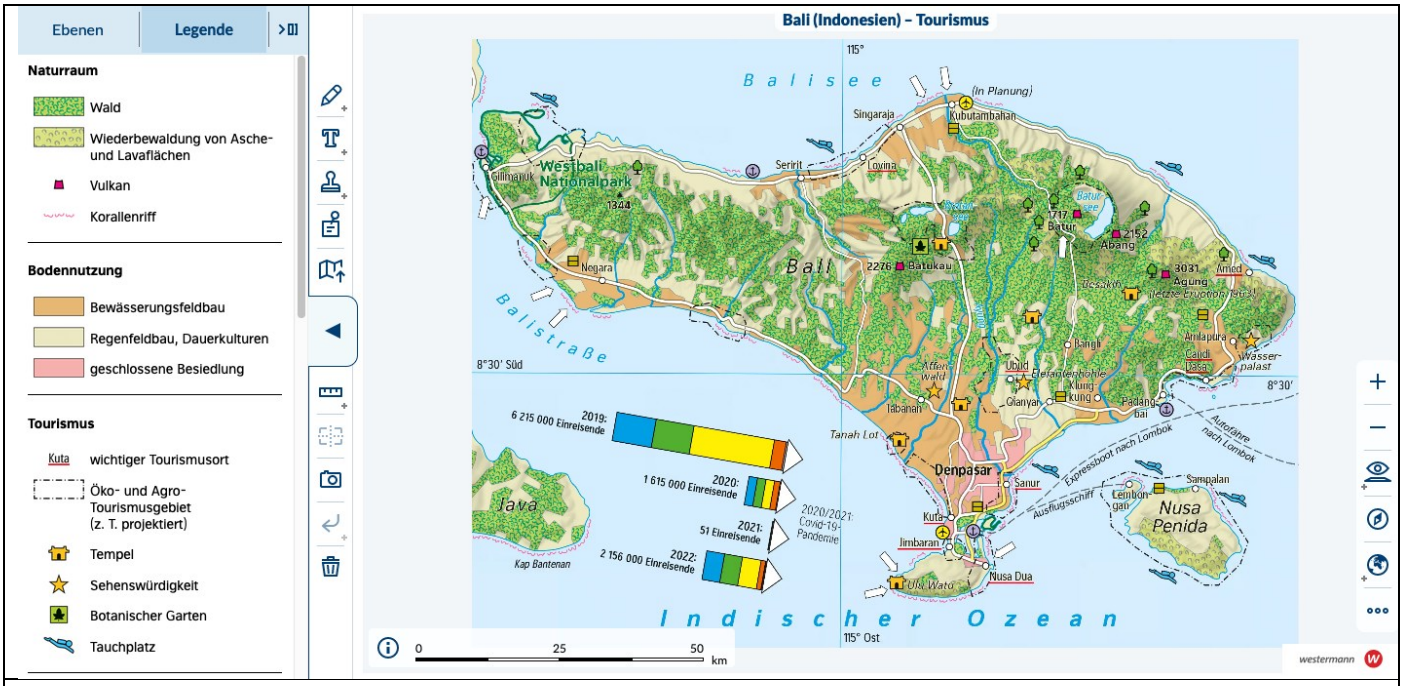
As stated earlier, students' views have barely been included in studies on multilingualism, particularly within the realm of geography education. These views are dynamic and shaped by students' prior experiences in educational settings, as well as within their families (Ellis, 2008; Haukås et al., 2022). Importantly, students' views influence learning and outcomes, particularly in multilingual education settings. Thus, integrating student views into multilingual geography education settings is important, as it may serve as a lens through which students experience the integration of different languages in multilingual geography education settings (Haukås et al., 2022; Jessner, 2016). Furthermore, understanding students' attitudes toward multilingual geography education empowers them with agency within the multilingualism process at school (Ellis, 2008). By acknowledging and integrating student views, educators can create more inclusive and effective multilingual learning environments that include the diverse language needs and experiences of students (Ellis, 2008; Thompson & Aslan, 2015).

2.4 Language in geography education

In addition to the variety and proficiency of the language repertoires that students possess, the role of geographical language is particularly important in geography education. The use of geographical language in geography lessons is discipline-specific and characteristic of the subject. Geographical language skills in geography education aim to ensure that language is understood as a tool for conveying and acquiring geographical content and can be an indicator of conceptual understanding (Kirk, 1995; Morawski & Budke, 2017). The geographical language used in geography lessons is a basic prerequisite for the teaching and learning of geographical concepts and meanings, the acquisition of knowledge of geographical content relating to human-environment relationships, and the communication of this knowledge (Gallagher & Leahy, 2019; Kirk, 1995). To elaborate, geographical language also plays a central role in shaping learners' access to *powerful geographical knowledge*—knowledge that allows students to move beyond their everyday experiences and engage with abstract understandings of the world (Young, 2008; Roberts, 2014). The subject-specific nature of geography requires language use that supports conceptual thinking, abstraction, and systemic reasoning. For instance, geographical concepts and meanings are constructed and conveyed through written and spoken language, with language itself shaping mental representations and frameworks for understanding complex human-environmental relations and their representations (Gallagher & Leahy, 2019; Robinson, 2005). This results in the understanding that language and content are reciprocal interdependence. This understanding emphasizes the importance of incorporating geographical language into geography education, particularly regarding accessing contextual meanings (Fang et al., 2006; Schleppegrell, 2004). Thus, acquiring geographical language in geography lessons is also an explicit learning goal and should be understood as a tool to enable differentiated and conceptually grounded geographical learning. Moreover, mental constructs of geographical concepts and meanings are represented and accessed through language (Heine et al., 2018; Prediger & Hardy, 2023; Saeed, 2015). Therefore, the successful acquisition of these concepts—including their mental storage and retrieval—is closely tied to students' ability to understand and use geographical language. This includes an awareness of both the implicit and explicit rules of geographical language use. This aims to acquire the ability to use geographical language in a context-appropriate and differentiated manner, providing students with a sense of agency. This requires learners to be able to communicate about content, both orally and in writing. In this way, fostering language proficiency in geography education is crucial for supporting all learners—especially those with diverse linguistic backgrounds—in accessing *powerful knowledge* and participating equitably in geography education (de Miguel González, 2024).

2.5 Language connected to maps

Maps contain spatial information, are regarded as noncontinuous text, and therefore have a language-related component (OECD, 2000; Pétera et al., 2016). Accordingly, geographical language acquisition in geography education is linked not only to cognitive skills but also to students' language skills in reading, describing, and interpreting maps as noncontinuous texts. Thus, a connection between language and the cognitive skills of decoding and encoding noncontinuous texts, such as maps, is a component of geography education (OECD, 2000). Unlike continuous texts, which describe concepts with words, maps have inherent structural features that represent spatial features, such as line signatures for railroad lines or roads (Kimerling et al., 2016). While texts describe information sequentially, the spatial information on the map is displayed in parallel (Kimerling et al., 2016). Due to the abstract spatial information density, it can lead to challenging demands in reading, describing, and interpreting maps. Thus, the acquisition of geographical language use is also linked to learners' language skills in dealing with maps (Budke et al., 2017; Gersmehl & Andrews, 1986). Figure 1 shows an exemplary map of tourism in Bali from the German Diercke World Atlas. Given that mass tourism is a mandatory topic in secondary-level geography curricula and education standards, the use of a map illustrating the touristic potential of a distant vacation destination such as Bali—beyond the scope of students' immediate personal experience—highlights the topic's significance in addressing both global and local impacts (German Geographical Society, 2012). The map's legend includes map-related words and graphic elements that must be decoded (read) on the map. For instance, the compound *coral reef* and the graphical representation of the concept function as language requirements connected to this map. The legend of the map (see Figure 1) served as the basis to conceptualize the language demands at the word level (Schleppegrell, 2004). In geography education settings, these words and related concepts in the legend of the map represented need to be decoded to describe and interpret the map (see Figure 1) in spoken but mostly written, production formats. In these so-called text production tasks connected to maps, understanding writing is a conscious and particularly demanding task, as cartographic decoding is required in advance (Frank et al., 2010; Li et al., 2024). According to Kellogg et al. (1996), the process of text production involves translating mentally stored conceptual ideas into syntactically encoded words. In the context of describing maps, it corresponds to students' lexical retrieval of priorly decoded and processed cartographic symbols and colouring schemes to express cartographic ideas for a geographical task in a text production task (Frank et al., 2010; Li et al., 2024).



Language dimension at the word level:

Description: *Geographical language connected to the respective map at the word level includes terminology that carries the cartographic meaning of concepts that need to be cognitively accessed and decoded (Heine et al., 2018; Spires et al., 2018). Cartographic features in the legend represented on the map are the basis for describing terminology (Mittelstädt, 1983). Thus, the following terms were conceptualized based on the respective map legends.*

Language Representation: Map-related words: *Map title, cardinal directions, Northern Hemisphere, Southern Hemisphere, legend, scale, urban settlement, city, highway, road, area signature, botanic garden, land use, forest, irrigation farming, rainfed agriculture and permanent crops, reforestation of ash and lava areas, national park, volcano, coral reef, harbor, airport, landfill, reforestation project, important tourist destination, eco- and agro-tourism, temple; sight, diver, dive*

Figure 1. Conceptualized Language Demands at Word Level Connected to the Map: Tourism in Bali from the German Diercke World Atlas. Source: Diercke Weltatlas (2023)

3. Research Questions

Based on the theoretically derived research desideratum regarding the explicit consideration of students' language repertoires in studies on language in geography education, as well as the integration of multilingualism as a learning resource in map-based geography education settings, the overarching aim of the present study is established: *How can different language repertoires be used as a learning resource to access spatial information in a map-based task?* To investigate the overarching aim of the present study, the following research questions (RQs) are addressed to shed light on multilingual, map-based geography education settings and students' views.

- RQ1: To what extent can multilingual map-based geography education settings encourage students to use their language repertoires as learning resources to acquire words in the legend of maps and apply them in the target language in written text production?
- RQ2: What are students' views on multilingual map-based geography education settings?

4. Method

4.1 Participants

Twenty upper secondary students, six of whom spoke a different heritage language, participated in the exploratory qualitative study. The sample consisted of male students (n = 14) and female students (n = 6). The participants exhibited high heterogeneity in terms of age, linguistic and ethnic backgrounds, and academic achievements. The average age of the participants was 16 years (SD = 1.1). Participants in the respective sample included individuals with ethnic backgrounds originating from Russia, Kazakhstan, Ukraine, Tajikistan, Jordan, and Turkey. The majority of the participants (60%) reported consistently speaking the target language, German, at home, while 20% indicated almost always using German at home. An additional 20% of participants reported speaking another language besides German at home, such as Russian or Arabic. The academic achievements, as indicated by grades in German, mathematics, and geography, exhibited a high degree of heterogeneity, with mean grades ranging from medium to poor across respective subjects.

4.2 Data Collection

The students participated in an explorative qualitative research design (see Appendix A–B) and were informed comprehensively and transparently about their rights, as well as the aims and purposes of the study. The participants needed to be made aware that nonparticipation would

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not result in any disadvantages for them. Their right to withdraw could be exercised until the completion of the anonymization process. The voluntariness of participation was emphasized in this study, which is why no compensation was provided. This highlighted that participation was not motivated by external incentives but occurred solely voluntarily. The participants were assigned anonymous codes that ensured that their identities remained confidential. In Phase 1, the participants were welcomed and informed to engage in a multilingual map-based geography education task (see Figure 1). In Phase 2, the participants were instructed to form monolingual groups based on their heritage language or a foreign language of their choice (language repertoires) to play a prepared map-based memory task. The memory task consisted of cartographic terms and graphic elements needed for decoding the map and was developed based on the legend of the map: Tourism in Bali from the German Diercke World Atlas. Figure 2 illustrates an extract of the memory task that was handed out to the students. This map was particularly well suited for the qualitative research design, as it depicts the touristic potential of an island beyond the participants' own experiences. Since mass tourism is a mandatory topic in secondary-level geography curricula (German Geographical Society, 2012), the map's content aligns closely with curricular requirements and provides an opportunity to investigate students' understanding of map-related vocabulary and associated geographical concepts beyond their immediate context.

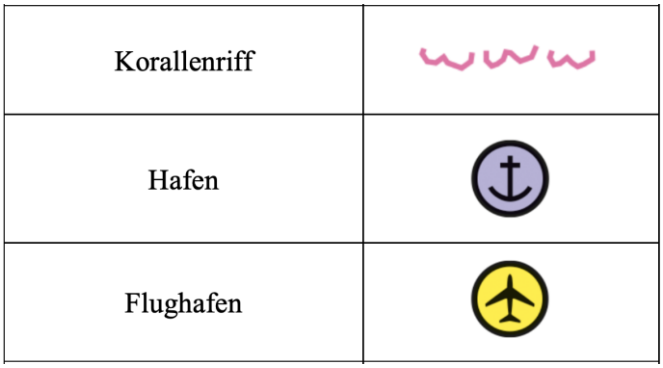

Figure 2. Extract from the memory task developed based on the legend of the Map: Tourism in Bali from the German Diercke World Atlas adapted based on Heuzeroth (2017). Source: Diercke Weltatlas (2023) (Note: German words translated into English: Korallenriff: coral reef, Hafen: harbor, Flughafen: port)

Phase 2 involved allowing the participants to translate these cartographic terms from the legend into any language which helped create more depth in understanding the cartographic concepts and mediate meaning. The memory was played in an open multilingual education setting (see Appendix A). Thus, in this phase, the participants were surrounded by different languages while engaging in the memory task. The researcher did not intervene. In Phase 3, the researcher instructed the participants to describe the touristic potential of the respective map in the atlas through a written text production task using the target language, German. The term touristic potential was explained, and students were then instructed to describe it based on the map (see Appendix B). Following solving the task, the students evaluated and analyzed the task in terms of difficulty in closed response formats and perceived benefits and challenges in open response formats. The sociodemographic items for our research design, especially on ethnic and linguistic backgrounds, as well as the academic achievements of participants, were adapted based on Beese et al. (2022) from Trends in International Mathematics and Science Study.

4.3 Data Analysis

The participants were assigned encrypted codes to prevent the identification of personal data. Furthermore, the qualitative analysis of the text production was based on the language demands associated with the map, which had previously been conceptualized at the word level (see Figure 1). These served as a concept-driven coding scheme applied to the students' written texts, per qualitative content analysis, as outlined by Mayring (2014). *In Table 1, an exemplary application of concept-driven coding is shown to clarify the operationalization of the coding scheme.* The implementation of map-related words, as conceptualized in Figure 1, was qualitatively analyzed in the written texts. The correct spelling and use were also assessed. Since the written text production task aimed at assessing the use of the acquired words from the legend of the respective map, the results were categorized into three performance levels based on the number of correctly used words: high (14–10 words), medium (9–5 words), and low (4–0 words).

Table 1. Exemplary Application of the Concept-Driven Coding Scheme (Figure 1) Based on Gisela's Written Text Production Task

Original text in German	**Translated text in English**	**Assessed words based on concept-driven scheme**
Im Süden der Insel ist ein wichtiger Tourismusort. Verteilt über mehrere km gibt es Orte an denen man Tauchen kann. In der Stadt verteilt kann man sich Tempel anschauen und andere weitere Sehenswürdigkeiten. Es gibt Korallenriffe zu entdecken. Im norden der Insel gibt es einen Flughafen, dort kann man landen um einen tollen Urlaub zu genießen. Im osten gibt es drei Vulkane und in allen Himmelsrichtugnen gibt es einen Hafen. An diesem kannst du ebenfalls an und abreisen.	In the south of the island, there is an important tourist destination. Spread out over several km, there are places where you can go diving. In the city, you can visit temples and other sights. There are coral reefs to discover. In the north of the island there is an airport. In the east, there are three volcanoes, and in all cardinal directions, there is a harbor where people can also arrive and depart.	important tourist destination, diving, city, temple, sight, coral reef, airport, volcano, cardinal direction, harbor

The ten coded words in Gisela's written text production are based on the concept-driven coding scheme (Figure 1). All of the map-related words previously engaged in were also spelled correctly and used appropriately within the text (see Appendix C for the original text). Although the questionnaires were filled in briefly, exemplary quotes from all participants' responses have been included to provide insights into students' views regarding their multilingual map-based geography lesson.

5. Results

5.1. RQ1: To what extent can multilingual map-based geography education settings encourage students to use their language repertoires as learning resources to acquire words in the legend of maps and apply them in the target language in written text production?

The results of the analysis of the use of map-related words in written text production following the respective map-based task (see Table 2) in the target language revealed a high degree of heterogeneity among the participants in terms of the total number of words written, the number of assessed map-related words, and their correct use and spelling. Table 2 illustrates the detailed findings regarding total words, assessed words, correct word usage, and spelling. To illustrate the results, the participants were given fictitious names in alphabetical order. Overall, the participants used an average of 79 total words written in the text production, ranging from the lowest number of 16 total words written by Ulli to the highest number of 161 total words written by Clara. On average, the analysis revealed that the students with differing heritage languages wrote about 19% fewer words in the text production task compared to their peers.

Concerning the assessed map-related words, the results illustrated in column 5 of Table 2 indicate that all the participants in the study used map-related words they had previously engaged with in the memory task, although to varying degrees. The results indicate that the map-related words most frequently used by the participants in the present studies were comparably shorter and of high everyday relevance and connection to the students' everyday lives (e.g., *airport, dive,* and *harbor*). More complex map-related words with intricate geography-specific meanings and no direct everyday relevance outside the participants' experiential knowledge were majorly avoided, despite prior engagement with them in the memory task (e.g., *reforestation of ash and lava areas*). Thus, the results indicate that while the participants are adept at integrating map-related words, representing rather simple concepts accurately, they avoid complex words. In addition, it becomes evident that as more map-related words are included in the participants' map-based written text production tasks, the lexical diversity and complexity of the words used increase. The lexical diversity and complexity of a broader range can be illustrated by the map-related words used by Alex (n = 14: *airport (3), dive (2), eco- and agro-tourism, harbor (2), legend (2), sight, temple, volcano, and word scale*). In addition to the most frequently represented map-related words, such as *airport*, *dive*, and *harbor*, this student also incorporated terms such as *eco and agro-tourism, temple, and volcano* into their written text. Similar results were presented by Bene, Dima, and Emma. The use of a broader range of map-related words not only reflects a higher level of engagement with the map-related words from the memory but also allows the participants for a more nuanced and precise expression of geographical meanings, as the map-related words used were mostly correctly implemented within the sentences of the text indicating an understanding of their meaning. This can be highlighted by the following excerpt from the text of Dima, a high-performing student: "In the east, the presence of the diving symbol indicates that divers are also active in that area." This excerpt reflects a clear understanding of the map-related word and symbolic element, including the touristic potential represented on the map. In contrast, Peer, a low-performing student, provided a more generalized description in the written text production task: "There are many places around Bali where you can go swimming." This sentence is not wrong; however, it is not as precise, as it lacks the use of map-related vocabulary and does not explicitly reference the symbolic content of the map that was previously introduced and required to describe the characteristic touristic potential represented.

Despite the varying degrees of assessed map-related words and the previously described shorter texts produced by students with different heritage languages, these participants slightly outperformed their peers in recalling and implementing map-related words from memory in their texts. Alex showed the highest number of assessed map-related words in his produced text within the sample. Above that, the participants in the sample used map-related words from the legend in the correct context within the produced text (see Table 2). In addition, these students showed that each word they included was used correctly, which contributed to their awareness of the respective geographical meaning of the concept behind the map-related word within the produced text. Overall, students with different heritage languages represented high or medium overall performance in light of the multilingual map-based geography education setting and even outperformed a few peers in using map-related words in their produced text. This is highlighted by two high-performing students, Alex and Dima, both of whom have different heritage languages. For example, Dima writes, *"[…] Altogether, the map shows four harbors in the south, east, west, and north. Additionally, the map displays a huge national park that mainly consists of forests."* Above that, a medium-performing student, Janel, demonstrates map-related word use in their respective texts: *"The map shows Bali and the word scale is 1:1,000,000. […] Within the island there are forests and around the island, there are coral reefs."*

5.2. RQ2: What are students' views on multilingual, map-based geography education settings? Students' Perceived Benefits in Multilingual Geography Education Settings

The analysis of the students' feedback on multilingual geography settings revealed some perceived benefits that resonated with the study participants. The key themes from the students' responses regarding their perceived benefits and overall enjoyment of these educational experiences are described. A recurring theme in the feedback was the students' enthusiasm for learning in an intercultural setting surrounded by different languages. One student expressed, *"I found it very cool as I don't know anything about other nationalities and I would love to learn more about them!"* (Source: Emma). Several students noted their enjoyment in expanding their vocabulary regarding their language repertoires within a multilingual map-based geography setting. For instance, Clara stated, "To think again, or one had to think about what individual words meant in their own language." One student remarked, "It was fun and I learned new words!" (Source: Janel), while another added, "Fun to learn new words" (Source: Alex). This feedback suggests that incorporating students' language repertoires not only enriched and expanded their vocabulary within these repertoires but also made the experience of encountering and using new terms in a geography lesson enjoyable. In addition, students with heritage languages different from the target language highlighted significant learning outcomes from their participation in multilingual geography settings; for example, one participant noted, *"I could really learn things today"* (source: Dima). This comment indicates that students with heritage

languages different from the target language were able to actively participate in the multilingual geography lesson by including the language resources of students.

5.3. Students' Challenges in Multilingual Geography Education Settings

The results of the student feedback on multilingual geography settings revealed some areas of perceived challenges. A common issue identified by students was the perceived short time allocated for the tasks. Several students reported that they needed more time to engage fully in multilingual map-based tasks. One student stated, *"I needed more time"* (source: Janel), and another commented, *"too little time"* (source: Alex). These responses suggest that the time constraints imposed during the activities may have limited the students' ability to engage thoroughly in the multilingual map-based task. Another concern was the overwhelming nature of being surrounded by multiple languages simultaneously. A student expressed, *"It was a bit overwhelming to be surrounded by different languages"* (source: Stella). This feedback indicates that the presence of several languages in the learning environment might have created an overload for some students. This notion of perceived challenges in multilingual learning environments was further supported by a student's written remark: *"You couldn't understand the other languages."* (Source: Ian). The comment highlights the student's unfamiliarity with the multilingual approach, which may have contributed to a sense of frustration.

Table 2. Results of Participants' Word Use in Their Map-Based Text Production Task

Participants	**Heritage Language**	**Total Words**	**Assessed Words from Memory in the Text Production Task**				**Overall Assessment (high, medium, low)**
			Absolute Frequency	Assessed words	Frequency of correct usage	Frequency of correct spelling	
Alex	Russian	82	14	Airport (3), dive (2), eco- and agro-tourism harbor (2), legend (2), sight, temple, volcano, and word scale	12	13	high
Bene	German	152	12	Airport (2), botanic garden, coral reef, dive, forest, harbor, landfill, legend, national park, temple, word scale	12	12	high
Clara	German	161	11	Airport, city, coral reef, dive, harbor (2), legend, national park (2), temple and volcano	11	8	high
Dima	Arabic	124	11	Dive (2), diver, forest (2), harbor, legend, road, Southern Hemisphere, volcano, and word scale	11	11	high
Emma	German	116	11	Airport, diver (4), dive, national park, sight, Southern Hemisphere, temple, and word scale	11	11	high
Fritzi	German	84	10	Airport (2), dive, eco- and agro-tourism, legend, national park (2), road (2), and word scale	10	10	high
Gisela	German	68	10	Airport, cardinal direction, coral reef, dive, harbor, important tourist destination, sight, temple, and volcano	10	10	high
Helge	German	119	8	Airport, dive (2), important tourist destination, legend (3), and word scale	8	7	medium
Ian	German	95	8	Dive (3), highway, sight (3), and temple	8	5	medium
Janel	Russian	65	8	Airport (2), dive, harbor, legend, sight, word scale, and temple	8	5	medium
Karl	German	101	7	Airport, dive, land use, legend, Southern hemisphere, temple, and word scale	7	7	medium
Linus	German	77	7	Airport, dive (2), harbor (3), and temple	7	1	medium

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Mia	German	81	6	Airport, cardinal directions, coral reef, dive, harbor, and important tourist destination	6	6	medium
Nikola	Russian	38	6	Airport, coral reef, harbor, sights, volcano, and word scale	6	6	medium
Onan	Turkish/ Arabic	56	5	Airport (2), harbor, important tourist destination, and volcano	5	4	medium
Peer	German	55	4	Harbor, important tourist destination, and sight (2)	4	1	low
Renat	Russian	32	3	Airport, harbor, and word scale	3	3	low
Stella	German	38	2	Important tourist destination and legend	2	1	low
Till	German	23	1	Word scale	1	1	low
Ulli	German	16	1	Word scale	1	1	low

6. Discussion

The purpose of this study was to shed light on a multilingual geography education approach that enables students to use their language repertoires as learning resources for accessing spatial information in map-based tasks, as well as to explore students' perspectives on multilingual geography education settings. The following three key findings are discussed:

1. **The multilingual map-based memory task allowed for the linguistic emphasis on short words connected to students' everyday experience, but did not lead to the holistic acquisition of more lexically complex words.**
   1.1 This result highlights that the use of language repertoires in the context of the memory task primarily encouraged retrieval from the mental lexicon for less complex map-related words. Short words are typically easier to process and remember because they impose a lower cognitive demand. When these words are tied to students' daily experiences, they create strong contextual cues that aid in memory retrieval (Li et al., 2024). Thus, this finding is in accordance with the literature: the higher the linguistic demand, including the embedded cartographic meaning of concepts, the greater the obstacles to language use (Heine et al., 2018; Snow & Uccelli, 2009; Spires et al. 2018). Interestingly, the participants were encouraged to use words from the memory task in their written text production. However, this multilingual approach did not largely support students in acquiring and using lexically longer and semantically more complex words, which were generally avoided in their texts.
2. **The multilingual map-based geography education approach encourages students to use their heritage languages as learning resources so that they perform as well as their peers in implementing map-related words correctly in their written texts.**
   2.1 Despite the shorter length of texts produced by students with heritage languages other than the target language, the proposed multilingual setting of the map-based memory task enabled these students to draw on their heritage language repertoires as learning resources. This supports their ability to retrieve map-related terms from their mental lexicon and apply them accurately in the target language (Karlsson et al., 2020; Li et al., 2024). This finding suggests that students with diverse heritage language backgrounds were able to use map-related words with a deeper understanding of the geographical concepts represented by vocabulary. By leveraging their multilingual repertoires, they demonstrated a more nuanced grasp of cartographic concepts and expressed their insights with greater precision (Charamba, 2020; Prediger & Redder, 2020). Such task-related use of language repertoires as a tool may contribute to more equitable learning environments, allowing all students—regardless of language proficiency—to access and engage with powerful geographical knowledge (de Miguel González, 2024; Young, 2008). In addition, it highlights the important role of multilingual approaches and equitable learning environments in geography education for all students.
3. **Students' views on multilingualism were highly heterogeneous, ranging from perceived benefits to challenges, underlining the novelty of multilingual geography education settings.**
   3.1 This finding emphasizes upper secondary students' views on the complex interplay between perceptions of multilingualism and experiences within school settings. On the one hand, our findings highlight that participants within the sample were motivated to actively engage in the multilingual map-based memory task. In addition, it is interesting that students who used their foreign language repertoires perceived the benefits of integrating multilingualism into geography learning. The findings regarding the perceived benefits of including heritage language repertoires contributed to the notion that the participants with a heritage lan-

guage different from the target language perceived multilingual geography education as beneficial for their educational development. This notion may have contributed to these students' sense of agency and empowerment, irrespective of the linguistic barriers to active participation in school (Haukås et al., 2022; Karlsson et al., 2020; Paris, 2012). Furthermore, the perceived benefits created a positive learning experience in a multilingual geography education setting and increased motivation (Haukås et al., 2022; Thompson & Aslan, 2015). The inclusive notion of multilingual geography education, which counteracts monolingual implicitness, is supported by these perceived benefits (Gogolin, 2021). On the other hand, it is interesting that the participants requested more time for multilingual tasks and viewed time as a challenge. Additional perceived challenges of overwhelm contribute to the novelty of multilingual geography education settings. Thus, this finding highlights the significance of incorporating students' views and perceived challenges throughout the process of the novel approach to designing inclusive multilingual geography education in accordance with students' needs and experiences (Thompson & Aslan, 2015).

6.1 Limitations

The present study has several limitations. First, the results cannot be generalized due to the small sample size and the limited number of students with heritage languages differing from the target language. Second, reliance on self-reported data may introduce bias, as students might provide socially desirable responses or may not accurately recall their experiences and perceptions. Third, student responses were limited in both length and depth, which constrained the extent to which their perspectives on the approach could be fully explored. The brevity of responses may have resulted from various factors, such as students' language proficiency, engagement level, or the nature of the data collection process. As a result, the findings provide only partial insight into students' perceptions. Fourth, while the data analysis of map-related words was rich and insightful, it did not include an analysis of syntactic complexity at the sentence level or the coherence of the texts. This omission may limit the ability to fully capture the language levels of students' map-based written texts within a multilingual geography education setting. Fifth, the instrument used for data collection—specifically the written text production task following an engaging memory task—may have posed challenges for students with limited writing skills. In particular, the task may have disadvantaged students with lower levels of writing proficiency, potentially affecting their ability to fully demonstrate their understanding of map-related vocabulary in context. Sixth, the coding scheme focused on the presence and accuracy of specific map-related terms but did not account for students' profound conceptual understanding beyond the correct use of terminology within a sentence.

6.2 Pedagogical Implications

Despite the limitations, the results of the present study suggest several pedagogical implications for multilingual geography education. Multilingual geography education requires pre- and in-service teacher agency to integrate students' language repertoires, although they might be outside of the teacher's scope. Thus, there is a crucial need to empower pre- and in-service geography teachers to adapt their educational approaches and embrace ways of teaching and learning geography in which students use their language repertoires as diversely as they are as learning resources for profound meaning creation. This includes the support of developing their language and geographical knowledge and skills (Karlsson et al., 2020). It is an equitable education approach that allows heterogeneous learners to perform by integrating their diverse language repertoires as learning resources (Kersting et al., 2024; Salloum et al., 2020). This notion calls for professional development among pre- and in-service geography teachers to gain knowledge and skills on how to integrate language repertoires as resources into geography lessons (Seah & Silver, 2020). In addition, to facilitate the acquisition of both simple and complex map-related words, teachers should provide a variety of tasks that balance immediate relevance with deeper, more varied engagement with words and concepts (Alexander, 2018). This approach should be rich in context and designed to support the learning of complex vocabulary. Understanding geographical concepts and meanings is crucial for describing and interpreting a map's legend and accessing spatial information effectively. An understanding of these terms enables users to decode the symbols and codes used in the legend, facilitating a clearer comprehension of the map's content and the spatial relationships it represents. Without a solid grasp of these specialized terms (Gallagher and Leahy, 2019), users may struggle to accurately describe and interpret the map's information, which can hinder their ability to acquire map skills (Frank et al., 2010). The use of scaffolding techniques to gradually introduce lexically complex words in phrases: Starting with simpler, familiar words and progressively integrating more challenging vocabulary can help build a stronger lexical foundation (Hammond & Gibbons, 2005). The explicit and transparent integration of students' views in the process of designing and evaluating multilingual geography lessons is crucial, as students' needs and beliefs shape their learning experiences. Therefore, it is essential to include these perspectives throughout the process (Haukås et al., 2022). Future research should focus on incorporating a larger and more diverse sample to enhance the generalizability of the findings. Additionally, including interviews could provide deeper insights into students' reasoning and engagement with the approach while encouraging more detailed responses on their educational needs throughout the process. Furthermore, exploring teachers' perspectives on integrating multilingual approaches into geography education is essential for future research.

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Appendix A: Extract From Multilingual Memory Task from Phase 1

Mehrsprachigkeit Testheft Seite 4

Aufgabe: Übersetze die Fachbegriffe in deine Herkunftssprache oder Fremdsprache deiner Wahl.

Aufgabe: Führe das Memory durch.

Zielsprache/ Herkunftssprache	Kartendarstellung
Vulkan	
Korallenriff	
Hafen	
Flughafen	
Mülldeponie	
Wiederaufforstungsprojekt	

Translation:
1. Task: Translate the technical terms into your heritage language or a foreign language of your choice.
2. Task: Participate in the memory game.

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Appendix B: Written Text Production Task of Phase 3

Mehrsprachigkeit Testheft Seite 13

Aufgabe: Beschreibe die Karte unter besonderer Berücksichtigung der räumlichen Verteilung des **touristischen Potenzials*** in Bali (Atlas S. 297). Nutze gelernte Begriffe und Sätze.

***Touristisches Potenzial (Erklärung)**: Räumliche Lage und Verteilung von touristischer Infrastruktur (z. B. Hotels, Flughafen, Sehenswürdigkeiten) für eine geeignete Freizeit- und Tourismusnutzung

Translation:
Task: Describe the map with a special focus on the spatial distribution of the touristic potential* in Bali (Atlas p. 297).

*Touristic potential (Explanation): Spatial location and distribution of touristic infrastructure (e.g., hotels, airport, and sights) suitable for leisure and tourism purposes.

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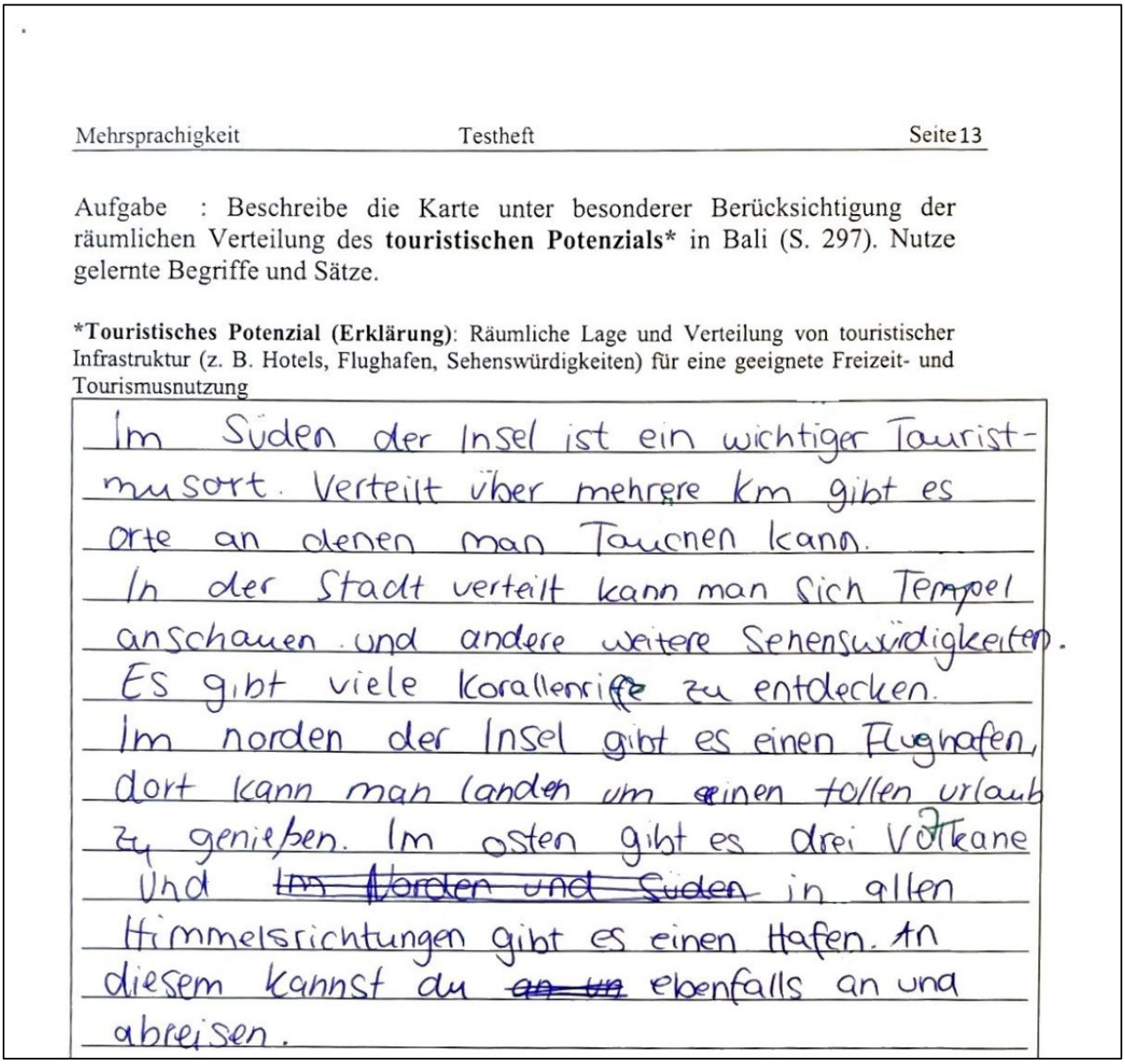
Appendix C: Original Text From Gisela (see translation in Table 1)



Mehrsprachigkeit Testheft Seite 13

Aufgabe : Beschreibe die Karte unter besonderer Berücksichtigung der räumlichen Verteilung des **touristischen Potenzials*** in Bali (S. 297). Nutze gelernte Begriffe und Sätze.

***Touristisches Potenzial (Erklärung)**: Räumliche Lage und Verteilung von touristischer Infrastruktur (z. B. Hotels, Flughafen, Sehenswürdigkeiten) für eine geeignete Freizeit- und Tourismusnutzung

Im Süden der Insel ist ein wichtiger Tourist-
mu sort. Verteilt über mehrere km gibt es
orte an denen man Tauchen kann.
In der Stadt verteilt kann man sich Tempel
anschauen und andere weitere Sehenswürdigkeiten.
Es gibt viele Korallenriffe zu entdecken.
Im norden der Insel gibt es einen Flughafen,
dort kann man landen um einen tollen urlaub
zu genießen. Im osten gibt es drei Vulkane
Und ~~im Norden und Süden~~ in allen
Himmelsrichtungen gibt es einen Hafen. An
diesem kannst du ~~an~~ ebenfalls an und
abreisen.

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