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THE USE OF DIGITAL TOOLS IN PRE-SERVICE TEACHERS' PROFESSIONAL DEVELOPMENT TOWARDS LINGUISTIC DIVERSITY IN PRIMARY EDUCATION

Summary. As language diversity in education gradually increases, several challenges for primary school teachers arise. According to previous studies, there are not many adequate teacher training programs that prepare teachers in linguistically diverse classrooms and, therefore, teachers that teach pupils with linguistically/culturally diverse backgrounds highly depend on their own engagement with plurilingualism. This shows the need for initial plurilingual(-oriented) pre-service teacher training and in-service teachers' continuing professional development that focus on acquiring language awareness and obtaining strategies for promoting and recognizing linguistic diversity in the classroom. In addition, most teachers feel the need for further professionalization and tools to help them manage and acknowledge the diversity in their classrooms. Through a pre-post-intervention design, this study examined a) the effects of digital tools for teacher professionalization for plurilingual education on pre-service teachers' attitudes and knowledge, and (b) how AR-games can be used to further language awareness and openness towards plurilingualism of pre-service teachers and their pupils. The participants reported that the digital tools contributed to their knowledge of linguistic diversity in the classroom, as well as ways to implement plurilingualism in their teaching practices and further language awareness.

Keywords: digital tools; language attitudes; language awareness; professional development; plurilingual education.

Introduction

Linguistic and cultural diversity are global phenomena that have been present in societies throughout history (Cenoz, 2013). The last decades have however been witnesses to unprecedented global migration flows, leading to a rising number of children who do not speak the language of instruction, or who speak another home language. This in turn resulted in linguistically heterogeneous classrooms becoming the norm in most urban areas across the globe (Spotti & Kroon, 2017). However, many teachers still favor forms of monolingual

instruction (Kirsch & Duarte, 2020), since underlying monolingual ideologies in education often cause linguistic diversity to be perceived as a threat (Liddicoat & Taylor-Leech, 2015). This increasingly leaves linguistically diverse pupils dealing with school languages, ideologies, and policies that do not align with their language practices at home (Spotti & Kroon, 2017). Yet, it has been found that using pupils' home languages in education positively influences their cognitive development, identity formation and pupils' sense of well-being and school belonging (Kirsch & Duarte, 2020).

In addition to monolingual ideologies, teachers' pedagogical practices are influenced by their own beliefs, attitudes and knowledge of plurilingualism (Diephuis, 2018), as described in the CEFR (Council of Europe, 2020). This in turn greatly influences the recognition of minority languages in the classroom (Tegene, 2016), teachers' expectations of their pupils (Diephuis, 2018) and has impact on general decision-making in education (Robinson-Jones, 2020).

Research has revealed that primary school teachers have moderate to low knowledge of plurilingualism and lack tools that could support the use of home languages in education (Van Gelder & Visser, 2005). According to Van Laere et al. (2017), technology could provide a solution, since digitalization – even more so in the wake of the COVID-19 pandemic – has offered new ways to tackle this issue. Studies have shown that using technology that supports pupils' home languages can stimulate the learning process of pupils (e.g., Clark et al., 2012; Lu et al., 2014), without the teacher having to speak all the home languages of their pupils (Van Laere et al., 2017). More specifically, (mobile) game-based learning (GBL) has been found to have great potential as a learning tool as it increases the engagement and motivation of pupils and positively influences their problem-solving skills (Girard et al., 2013). Besides the advantages for pupils, digital tools also offer advantages for teachers. Previous research shows that there is a significantly positive correlation between the use of (mobile) technology in the classroom and teachers' perceptions of the instructional benefits of technology (e.g., Furió et al., 2015). Furthermore, Foulger et al. (2017) found that the use of digital tools for professional development (PD) was considered positive by teachers in improving lesson quality but could only become part of teacher training programs if educational institutions and organizations also provided support for

the use of ICT in education.

There is a gap in knowledge on plurilingualism among teachers and their perceptions/beliefs largely influence the language practices in the classroom. Therefore, there is an urgent need to provide better guidance to teachers utilizing digital tools on how to implement plurilingualism in the classroom. This study uses a mixed-methods design (Creswell, 2016) and an intervention design (Fraser & Galinsky, 2010) to provide insights into teachers' attitudes towards plurilingualism in education, and their knowledge on plurilingual education by participating in an intervention program in which they experiment with different digital tools from the VirtuLApp¹ project. Further, this study provides insights into the impact of digital games on pupils' and pre-service teachers' language awareness. The following research questions will be addressed:

- (1) To what extent do digital tools used in teacher professionalization for plurilingual education have an impact on the attitudes and knowledge of pre-service teachers in primary education?
- (2) How can game-based learning be used to further language awareness and openness towards different languages of both pre-service teachers and their pupils?

The Use of Digital Tools for Teacher Professionalization Towards Plurilingual Approaches in Primary Education

Language Awareness and Language Attitudes

The Association for Language Awareness (ALA) defines language awareness (LA) as "[...] explicit knowledge about language, and conscious perception and

¹ The Virtual Language App, or VirtuLApp, is a 3-year Erasmus + Key action 2 Strategic Partnership project that aims to develop a multididactic approach which can be used by teachers in every (plurilingual) situation. The project is coordinated by the Mercator European Research Centre, hosted at the Fryske Akademy in Leeuwarden, The Netherlands. Other partners working on the project are ATIT (Belgium), Trinity College Dublin (Ireland), University of the Basque Country (Spain) and LUCA School of Arts (Belgium).

sensitivity in language learning, language teaching and language use" (ALA, 2021). However, Otwinowska (2014) mentions, as did Baker (1992), that 'language attitudes' seems to be "an umbrella term rather than a homogeneous notion" (p. 98). According to Baker (1992), the term not only covers attitudes towards languages in general but also towards particular dialects, language learning, and language use. In accordance with this, Cenoz (2009) points out that, with regard to languages, an attitude can be an evaluative reaction "towards a specific language or a specific language group (an object), or the activity of learning languages (event)" (p. 176). Related to language attitudes are the 'underlying' language ideologies that involve "cultural and personal conceptions of language and language varieties" (Fazaka, 2014, p.337). According to Fazaka (2014), language attitudes and ideologies are strongly related to each other and contain certain matters of values, norms, standards, and feelings about languages.

More recently LA has also been considered as a prerequisite for a plurilingual approach in education. LA causes pupils to develop an open attitude towards linguistic diversity, and it makes both pupils and teachers aware of the existence of multiple languages and their underlying cultures in the world, and specifically in the classroom (Sierens & Ramaut, 2018). Furthermore, Frijns et al. (2011) found that LA helps pupils to acquire knowledge about languages and to develop metalinguistic skills over time that can be used to further their learning of both foreign languages as well as their mother tongue. Teaching is also influenced by attitudes related to language ideologies, such as standardization or monolingual ideologies, which can affect pupils' linguistic practices (Farr & Song, 2011). According to Diephuis (2018), teachers' underlying language ideologies are shaped partly by society and have a major influence on their teacher practices.

Teacher Professionalization for Plurilingual Education

Plurilingual education can be defined as 'the use of two or more languages in education provided that schools aim at multilingualism and multiliteracy' (Cenoz & Gorter, 2015, p. 2), and often refers to schools that have three or more languages in the curriculum and that acknowledge pupils' diverse home

languages (Duarte & Günther-van der Meij, 2018). Nevertheless, teachers often lack knowledge about the development of plurilingual learners and the importance of their languages in education, which is mainly due to lack of teaching of the subject during teacher training (Van Gelder & Visser, 2005). According to Maude et al. (2010, p.105), "it is impossible to prepare tomorrow's teachers to succeed with all of the students they will meet without exploring how students' learning experiences are influenced by their home languages, cultures, and contexts". The acquisition of knowledge about linguistic diversity can be achieved through professional development that involves "teachers learning, learning how to learn, and transforming their knowledge into practice for the benefit of their students' growth" (Avalos, 2011, p.10). Professional development (PD) has been defined as: "the systematic effort to ensure that professionals are adequately qualified and to provide them with opportunities to complement, consolidate and develop their attitudes and knowledge" (Kirsch et al., 2020, p.190).

Maandag et al. (2017) argue that interventions at different times will demonstrate the PD of teachers. In interventions, it is important to address the didactical content to show the effectiveness of PD (Maandag et al., 2017). Flores & Smith (2008) state that teachers who have had more training in linguistic diversity hold more positive attitudes towards plurilingual pupils and their potential. However, research has also shown that due to the low impact of these programs on future teachers, educators are still opposed to "redefin[ing] pluricultural education" (Lenski et al., 2005, p.2). Therefore, this study explores the impact of a new approach for pre- and in-service teachers that focuses on promoting positive attitudes and knowledge on plurilingualism with the help of digital tools, thus addressing the key issue that teachers do not always have the right tools and knowledge to acknowledge and use pupils' home languages in the classroom (Hélot & Young, 2002). Although many types of studies have been conducted on the use of digital tools for pupils in plurilingual education (Van Laere et al., 2017), no research, to the best of our knowledge, has focused on the use of digital tools for teacher professionalization in the scope of plurilingual education. In this study, we will therefore explore the use of digital tools for teacher's PD concerning a plurilingual teaching approach.

The Use of Digital Tools in Education

In recent years, technology has been increasingly deployed in education, as it is a valuable tool for the acknowledgement of different languages and cultures and increases language awareness (Shih, 2015).

Furthermore, technology can also be used as a learning tool in teachers' PD, as Ratheeswari's (2018, p. 45) study showed that the use of ICT "improves teaching and learning and its importance for teachers in performing their role of creators of pedagogical environments". However, the use of ICT can only be effective if teachers get instructed on the integration of technology in the classroom. Furthermore, Haelermans (2017) argues that the implementation of ICT in schools can only maximize pupils' development if the digital tools are implemented correctly and therefore, teacher training should focus on the use and effectiveness of digital tools. In addition, Kirsch et al. (2020) argue that videos are commonly used in pre-service teacher professionalization in order "to engage [teachers] in systematic reflection of their planning and teaching" (p. 193). Hamre et al.'s (2012) study demonstrates that when videos are used in PD, teachers report more knowledge of interactional strategies and are better at identifying effective teacher-pupil interactions in the videos. Teachers also develop "stronger beliefs about the importance of teaching children early literacy and language skills and demonstrated greater knowledge about these skills" (p. 110).

A less frequently used tool in teacher's PD is games. Games can be aimed at "fostering teachers' participation and engagement in the training intervention" or provide support for "enhancing intrinsic motivation to adopt innovative approaches" (Pozzi et al., 2016, p.79). The emergence of digital tools has led to an increased popularity of mobile game-based learning (Klopfer et al., 2009).

Game-Based Learning

The use of games in education provides promising opportunities, since it "enables players to construct understanding actively, and at individual paces, and [...] well-designed games enable players to advance on different paths at

different rates in response to each player's interests and abilities, while also fostering collaboration and just-in-time learning" (Klopfer et al., 2009, p. 1). Furthermore, evidence suggests that playing educational games in collaboration with other pupils can have positive effects on learning gains and helps pupils in overcoming potential misconceptions about the content (Mikropoulos & Natsis, 2011). A technology that is new in mobile game-based learning (GBL) is Augmented Reality (AR). Furió et al. (2015) found that "with AR technology, traditional teaching materials are preserved and supplemented by virtual content" (p. 190) which led to a higher motivation and engagement of the pupils, since AR technology is what allows pupils to explore their learning content from a range of different perspectives (Kerawalla et al., 2006). This in turn would improve the learning experience of the pupils (Furió et al., 2015).

It was not until recently, when the VirtuLApp project developed the collaborative AR game BabelAR, that there was a game available specifically focusing on plurilingualism in the classroom. The game provides teachers with a tool to welcome linguistic diversity in the classroom and aims to increase language awareness of pupils and teachers, strengthen the identities of plurilingual pupils and show pupils the value of their language(s) (VirtuLApp, 2021). Therefore, the present study aims to explore how digital games in general and the BabelAR game specifically can stimulate the development of language awareness and openness towards different languages of pupils and pre-service teachers (*tools are open source on the website: www.VirtuLApp.eu*).

Methodology

This study employed a mixed-methods and an intervention design with a pre- and post-measurement (Creswell, 2016; Fraser & Galinsky, 2010) to evaluate the digital tools and game developed by VirtuLApp. During a four-week program, the pre-service teachers shared their experiences with a digital toolkit by sending weekly updates, providing evidence for the intervention design. Their attitudes towards plurilingual education were assessed before and after the intervention using a pre- and post-survey. Furthermore, their knowledge and language awareness were assessed by using thematic analysis

(Braun & Clark, 2006). In addition, several semi-structured interviews (Galletta & Cross, 2013) were conducted with a sub-sample of the pre-service teachers after they had completed the Intervention Program. The mixed-methods design allows for complementarity in the analysis, as the qualitative part of this study can provide more detailed insights into the results of the quantitative data (Wisdom, 2013).

Setting Of the Study

This study was conducted within the Virtual Language App (VirtuLApp), an Erasmus+ project (2019-2021), aiming at developing a multididactic approach which teachers can use in the classroom in any (plurilingual) situation. The needs of teachers – more knowledge about and tools for plurilingual education, integration of migrant languages and less language separation – were addressed with the development of a multi-player augmented reality game for plurilingual pupils and of a toolkit which consists of didactical videos with examples of practices of plurilingual education in the different settings and Frequently Asked Questions (FAQs) compiled among participating (pre-service) teachers and answered by experts in the field (including expert teachers). In this project, researchers and (pre-service) teachers in three highly diverse areas in Europe – the Basque Country, Belgium and the Netherlands (Friesland) – worked on developing these tools for plurilingual education.

Materials

Pre- and post-survey. A pre- and post-survey about plurilingualism in education was distributed online among the participants. The questionnaires were based on existing research and instruments (Gorter & Arocena 2020; Pulinx et al, 2017, Steunpunt Diversiteit en Leren, 2019; Fürstenau et al., 2014). The pre-survey consisted of 55 questions and the post-survey of 63 questions, containing multiple choice questions, open-ended questions and statements measured on a 5-point Likert scale (ranging from (1) 'Strongly disagree to (5) 'Strongly agree'). Mostly based on existing and validated scales,

the pre- and post-survey contained the following sections: 1. Thoughts on languages, 2. Teaching multiple languages and 3. Plurilingualism in the school. In addition, the post-survey contained additional sections about the FAQs, didactical videos and the BabelAR game (see Table 1). The scale reliability of the sections was measured using Cronbach's alpha, which measures internal consistency (UCLA, 2021). This means that a high value indicates that a set of items is relatively closely related as a group.

As Table 1 shows, sections 3 and 6 have a relatively low alpha score compared to the other sections, which means that, even though the scores are significant, the items in these sections are slightly less closely related.

Table 1

Sections and reliability of questionnaires

Scale	N Items	Type of scale	Cronbach's α	Source
1. Thoughts on languages	16	5-point Likert scale,	0.843	Gorter & Arocena (2020)
2. Teaching multiple languages	11	5-point Likert scale,	0.848	Pulinx et al (2017), Steunpunt diversiteit en leren (2019); Fürstenau, Huxel & Dickmann (2014)
3. Plurilingualism in the school	10	5-point Likert scale,	0.71	Pulinx et al (2017), Fürstenau, Huxel & Dickmann (2014)
4. The VirtuLApp didactical videos	6	5-point Likert scale, open-ended questions	0.869	VirtuLApp (2021)
5. The VirtuLApp FAQ videos	6	5-point likert scale, open-ended questions	0.937	VirtuLApp (2021)
6. The BabelAR game	6	5-point likert-scale, open-ended questions	0.751	VirtuLApp (2021)

Intervention Program. The Intervention Program was developed to evaluate the digital tools and the game developed by the VirtuLApp team. The program was spread over a period of 4 weeks, during which participants used the digital tools of VirtuLApp and gave a weekly update on the tools and their experiences with them. It consisted of using the following tools: 4 didactical videos, 17 Frequently Asked Questions (FAQs), and the augmented reality game called BabelAR.

Semi-structured interviews. Semi-structured interviews were conducted to further examine the experiences, views and beliefs of the participants. The interviews were to complement the answers given in the survey and the weekly update reflections. A sub-sample was used due to the fact that the participation was voluntary and only a number of participants were available for a 30-minute interview. The interviews were conducted via Google Meet due to the COVID-19 pandemic, either in English or Dutch. They were audio-recorded by the researchers and were transcribed verbatim. The transcripts were then analyzed using ATLAS.ti 9 in order to further explore the feedback given in the Intervention Program.

Participants and Procedure

Table 2

Overview of the participant characteristics per context and overall.

	Friesland (n = 5)	Basque Country (n = 16)	Flanders (n = 4)	Overall (n = 25)
Age				
Mean	19.8	21.88	24.5	21.88
Min-max	19-21	21-25	21-34	19-34
Gender				
Female	4 (80%)	11 (68.8%)	4 (100%)	19 (76%)
Male	1 (20%)	5 (31.2%)	-	6 (24%)
Year of study				
First-year bachelor	-	-	2 (50%)	2 (8%)
Second-year bachelor	5 (100%)	-	-	5 (20%)
Third-year bachelor	-	-	-	-

	Friesland (n = 5)	Basque Country (n = 16)	Flanders (n = 4)	Overall (n = 25)
Fourth-year bachelor	-	16 (100%)	2 (50%)	18 (72%)
Language diploma				
Yes	2 (40%)	16 (100%)	1 (25%)	19 (76%)
No	3 (60%)	-	3 (75%)	6 (24%)
Self-perceived plurilingualism				
Yes	2 (40%)	16 (100%)	4 (100%)	22 (88%)
No	3 (60%)	-	-	3 (12%)

For this study, purposive sampling (Allen, 2017) was used to “select respondents [i.e. pre-service teachers] that are most likely to yield appropriate and useful information” (Kelly, 2010, p. 317). The participants were recruited through the VirtuLApp partners and network, and they received the survey links and Intervention Program via email. A total of 25 pre-service teachers participated (see Table 2).

Even though all these regions are multilingual in the sense that the minority language has an official status, it is important to note that these three settings are quite different. First, Frisian and Basque are both minority languages that are spoken only in these regions of the respective countries, whereas French is indeed a minority language in Flanders, but not in Belgium as it is the official language in Wallonia (with the exception of the German-speaking communities). Secondly, the Frisian and Basque contexts are quite different from each other as well, as “the demography of [minority] languages and their status is very diverse” (Cenoz & Gorter, 2015, p. 476). Even though the Basque Country maintains a strong language policy in order to promote Basque, everyday use of the language is quite limited, except in education (Cenoz, 2008). The language policy in Frisian is not as strong, especially in education, but Frisian seems to be spoken in everyday life more frequently (Gorter, 2015).

Before participants’ participation in the intervention, they were asked to fill in the pre-survey. Following the pre-survey, participants received the instructions for the Intervention Program, and after they had completed the program, they were asked to fill in the post-survey. All participants filled

out a consent form for the pre- and post-survey, and for the interview. The interviews were conducted online, approximately one week after the participants had finished the intervention. These interviews had a duration of roughly 30 minutes and were audio-recorded by the researchers.

Data Analyses

To (partly) answer RQ1, a statistical analysis was conducted to determine the overall attitudes of pre-service teachers towards plurilingualism in education. The survey-items that measured the attitudes of the participants were assessed on a 5-point Likert-scale (1 = most negative, 5 = most positive). Some items were reversed. Due to a reduced sample size – caused by the COVID-19 pandemic – the data has been treated as a trend over time.

The pre- and post-surveys from the different contexts were treated as one for the statistical analysis due to the low response rate per context. This demonstrates the overall attitudes of pre-service teachers towards plurilingualism (in the classroom). To investigate the influence of the Intervention Program on attitudes, a Paired Samples *t*-test was conducted. In the post-survey, the attitudes towards the VirtuLApp digital tools were analyzed separately by using descriptive statistics.

To address RQ1 and RQ2, the reflections in the weekly updates, the open-ended questions in the surveys and the interviews were coded in ATLAS.ti 9 by using thematic analysis (Braun & Clarke, 2006). The themes were coded inductively using 33 codes for the *Didactical videos*, 37 for the *FAQs* and 3 for the *BabelAR Game*.

Results

Digital Tools for Teacher Professionalization

Attitudes. The overall attitude score towards plurilingualism in education of the participants on the pre-survey was 4.24 (SD=0.4), indicating that pre-service teachers were generally quite positive towards plurilingualism in the classroom and plurilingual education, already before they started the intervention. Nevertheless, a paired samples *t*-test showed that pre-service

teachers generally had a more positive overall attitude on the post-survey ($M = 4.27$, $SD = 0.4$) as compared to the pre-survey ($M = 4.24$, $SD = 0.4$). However, this difference failed to reach significance ($t(24) = 0.57$, $p = 0.58$), 95% CI [-0.076, 0.13]. It must be considered that this lack of significance could be due to the small sample size.

Regarding the different contexts, a statistical analysis revealed that pre-service teachers from Friesland were significantly less positive ($M = 3.75$, $SD = 0.35$) on the post-survey as compared to the pre-service teachers from both Flanders ($M = 4.52$, $SD = 0.37$), $p = 0.0032$, 95% CI [-1.29, -0.25] and the Basque Country ($M = 4.37$, $SD = 0.28$), $p = 0.0019$, 95% CI [-1.02, -0.23]. This means that even though the pre-service teachers from Friesland are relatively positive towards plurilingualism in education, they are more hesitant about it than the pre-service teachers from Flanders and the Basque Country. The difference between the pre-service teachers from Flanders and the Basque Country was insignificant.

Table 3

Overall mean attitude score of pre-service teachers towards the VirtuLApp tools

VirtuLApp tools (n=25)	Mean (SD)
Didactical videos	4.1 (.15)
Frequently Asked Videos (FAQs)	3.78 (.31)
Game	4.44 (.16)

Furthermore, a descriptive analysis was conducted to compare the overall mean score attitude of pre-service teachers towards the digital tools. As can be seen in Table 3, participants held a very positive attitude towards all the VirtuLApp tools, being most positive about the BabelAR game ($M=4.44$, $SD=.16$). In addition, pre-service teachers were slightly more positive towards the didactical videos ($M=4.1$, $SD=.084$) than towards the FAQ's ($M=3.78$, $SD=.31$).

Knowledge on plurilingualism. To further answer RQ1, responses to the open survey questions, the weekly reflections, and the interviews were analyzed using thematic analysis (Braun & Clarke, 2006). With regard to the code 'FAQs' (n = 37), many of the pre-service teachers reported that they watched a specific FAQ, because they did not have certain knowledge on a specific topic or because they wanted to gather more information on the topic. Moreover, participants reported that they learned new information, such as the inclusion of languages or the transfer of language skills. Regarding the negative points, participants reported on the difficulty of the English used in the videos, the generality of the answers provided and the substantiation of specific case studies with good practices. In addition, participants expressed their concerns about the implementation of the ideas presented in the videos, involvement with the parents, the link to the school vision, the communication with plurilingual pupils, and pupils' attitudes towards other languages than the school language.

Table 4

Quotes illustrating the pre-service teachers' experiences with the FAQs

Quote	Region
"They are useful to reflect at least. Or make you aware that your teaching could be improved. (..) at least I can get a starting point to start moving forward and you can establish some kind of space. And then you can search for books or training (..) to help you develop more of those skills"	Basque Country
"(..) there were so many different points of different professors and it was interesting to see and they didn't just give the theory but they linked it with practical approaches, so that was interesting"	Basque Country
"I think it is they give a lot of good practices and ways to make it easier to implement it so I think it will be easier for me to now really instead of having this idea I want to implement multilingualism in the classroom to just do it and take more initiative to really put my thoughts into actions"	Flanders
"I think with the videos I know better what I am doing, and I feel more comfortable (..) I can bring it to another teacher, a principal and say: 'watch the FAQs and spread the knowledge."	Flanders

Furthermore, most of the participants valued the content given in the videos which could help them face challenges in plurilingual education more easily since most of the questions answered were related to classroom practice (see Table 4 for quotes).

Regarding the code 'Didactical Videos' (n = 33), the pre-service teachers mentioned some practical issues, such as the length of the video and the need for subtitles in English. In general, most of the feedback on the didactical videos was positive feedback. Participants commented on the engagement of children in the videos, the involvement of parents in the video, the contribution of the video to own personal development, the contribution of the video to fostering positive attitudes towards plurilingualism, the benefits of plurilingual education mentioned in the video and the plurilingual activities presented in the videos (see Table 5).

Table 5

Quotes illustrating the pre-service teachers' experiences with the didactical videos

Quote	Region
"Having posters with different languages, such as a welcome poster can be very positive for those students who don't speak the school language. In this way, it will be easier for them to feel that their language is valued"	Basque Country
"(..) they show that it is possible to use multiple languages in the classroom without experiencing big problems it is really good to see how it works in practice"	Flanders
"I think that multilingualism in the classroom, using home languages in the classroom at all, really helps to promote the educational climate, especially for children with a different home language (..). As described in those videos, they must also have the feeling that their home language matters. And if they don't have that feeling, is there a safe pedagogical climate for those children?"	Friesland
"Some of them also talked about the pedagogical side, which was really helpful, because they also talked about research and so on"	Friesland

In addition, some pre-service teachers in Friesland put into practice some of the plurilingual activities presented in the didactical videos (see Figures 1 and 2). The teachers got acquainted with different activities they could integrate into their lessons to make plurilingualism more visible. They expressed that most pupils were not used to speaking their home language at school and found it difficult to talk about it. However, they were very enthusiastic and curious about the number of different languages spoken by their classmates. Also, the desire to implement more activities was being expressed: "For the next time, I would like to focus more on multilingualism in the classroom (if applicable) and also look at the culture of this country to get more experience in the lesson." (Pre-service teacher in Friesland).

Figure 1

Plurilingual poster on holidays

Nederlands	Engels	Spaans
TOP 5 Mooiste plaatsen Spanje	TOP 5 Most beautiful places Spain	TOP 5 Lugares más bonitos de España
* Strand	* Beach	* Playa
* Zee	* Sea	* Mar
* Vakantie huisje	* Holiday cottage	* Cabaña de vacaciones
* Zon	* Sun	* Sol
* Zonne Brand	* Sun Burn	* Bronceado
* Leuker werk	* Nice weather	* Buen Tiempo
* Korte broek	* Shorts	* Bermudas
* Korte mouw shirt	* Short sleeve shirt	* Camisa manga corta
* Slippers	* Flip Flaps	* Chancletas

Figure 2

Plurilingual poster on holidays



Lastly, regarding the theme 'BabelAR game', participants reported that they got inspired to implement BabelAR and other digital games. Also, some participants mentioned that it was very valuable for their own pedagogical work to see that it was possible to implement plurilingualism through the use of a digital tool and got inspired to implement it on their own (see Table 6).

Table 6

Quotes illustrating pre-service teachers' experience with the BabelAR game

Quote	Region
"(..) I think that the game shows it is easy and possible to implement languages in the classroom even if you don't know them yourself. I think a lot of teachers are kind of scared to use languages in the classroom that they do not themselves know, so it shows that there is a fun and good way to use the languages (..) I think that really when you know that it works in the game you can little by little try other exercises and see multilingualism as a bonus"	Flanders

Quote	Region
"You just have to try and practice. That's interesting and also for the teachers to say to see and compare the languages so yes for the teachers it is also very useful"	Flanders

Digital Games to Further Language Awareness and Openness

Impact on pupils. Participants mentioned the impact that the game had or would have on their pupils. They generally agreed that using the game increases language awareness and pupils' language attitudes. Most of the pre-service teachers referred to similarities between languages, and how this game is a fun way to look for these similarities. According to the pre-service teachers, pupils really need to rely on their entire linguistic repertoire to find the correct answer, and it makes children aware of the fact that there are people who speak other or multiple languages. It also engages them to learn new languages and it stimulates their interest in the languages others speak. Table 7 gives some examples of the aforementioned experiences.

Table 7

Quotes illustrating the impact of BabelAR on pupils

Quote	Region
"In that way they can see what the reality is, that there are so many languages spoken all over the world."	Basque Country
"It shows that even though you do not speak a language, you can do with it and you can learn about it."	Flanders
"I think that they will look differently at foreign languages [...], that maybe it is easier to learn a language or that it does not differ all that much."	Friesland

Furthermore, a pre-service teacher from Flanders mentioned that the game gives children with home languages different from the school language a sense of pride. In addition, BabelAR does not only raise linguistic awareness of pupils,

but it also makes monolingual pupils better understand their immigrant classmates according to a participant from Flanders, as “they can experience how it feels if you cannot understand the school language”.

Impact on pre-service teachers. The pre-service teachers also reported on the impact the game had on themselves. Many of the participants argue that playing the game and implementing it in the classroom had increased their own language awareness to some extent. Furthermore, some pre-service teachers from the Basque Country mentioned that the game had increased their overall knowledge on plurilingualism to a certain degree as well. Pre-service teachers from Flanders also reported that playing BabelAR had helped raise their own awareness on the benefits of plurilingualism. In addition, one of the Frisian participants stated that the game aids teachers in better understanding their pupils who are learning Dutch as a second language (see Table 8). Lastly, many of the participants reported that the BabelAR game inspired them to implement plurilingualism in their lessons to a larger extent.

Table 8

Quotes illustrating the impact of BabelAR on pre-service teachers

Quote	Region
“This made me realize even more that, even if I was playing the game in a language that I do not understand, I am able to use my resources.”	Basque Country
“It is interesting, and also for the teachers to see and compare the languages. So yes, for the teachers it is also very useful.”	Flanders
“You try to do it as well as possible, but that is actually what a NT2 [Dutch as second language] pupil does as well, for example. [...] I realized this last week while I was playing that game.”	Friesland

Table 9 gives an overview of the advantages and disadvantages that were reported by the participants regarding digital games in general and the BabelAR

game in particular. This table reveals that the use of digital games has much to offer in plurilingual classrooms.

Table 9

Overview of advantages and disadvantages of digital games in general and BabelAR in particular reported by the participants

Advantages	Disadvantages
Digital games	
- Suitable way to introduce plurilingualism and raise awareness	- It cannot be an activity on its own (it should be combined with other tools)
- Engages children to participate in the lessons	
- Motivates pupils to learn new languages and about plurilingualism	
- Pupils learn without noticing it	
BabelAR game	
- Raises language awareness of both pupils and teachers	- Not suited to play with children whose language(s) are not integrated
- Gives multilingual pupils a sense of pride	- Not suited to play with illiterate children
- Children can play it independently (without help from the teachers)	- Not suited to play in a whole-class arrangement
- AR aspect engages children to partake in the lesson	
- Stimulates collaboration	
- Makes both teachers and (monolingual) pupils better understand immigrant pupils	
- Increases teachers' knowledge on (benefits) plurilingualism	

Discussion

This study aimed at providing insights into the effects of digital tools on pre-

service teachers' attitudes and knowledge of plurilingual education (RQ1) and digital games to further language awareness and openness towards languages of both pupils and teachers (RQ2).

Influence Of Digital Tools for Teachers' Professionalization for Multilingual Education

Regarding the attitudes towards the digital tools, it was found that pre-service teachers' attitudes towards the VirtuLApp tools were positive to very positive. The quantitative analysis showed that the pre-service teachers were most positive towards the BabelAR game followed by the didactical videos and lastly, the FAQs. As the qualitative analysis revealed, the participants noted an increase in language awareness using both the game and the didactic videos. These findings suggest that digital tools are a useful way to increase (pre-service) teachers' language awareness.

With regard to the didactical videos, participants claimed that the videos helped them to understand and face difficulties in the classroom. This could explain why the teachers were less positive about the FAQs than the didactical videos since these videos include practical examples recorded in the classroom. Although the FAQs did not contribute as much to teacher language awareness, the pre-service teachers reported that the FAQs were most useful for their pedagogical work, since they mostly reported on the usefulness of the videos for facing certain challenges and creating a safe educational climate within plurilingual education. These results show that the use of technology in teacher training programs can be effective to improve their teaching practices and guide them in "performing their role of creators of pedagogical environments" (Ratheeswari, 2018).

The experiences with the BabelAR game showed that most participants reported that they learned to look at languages differently by comparing them. They claimed the game was beneficial for both teachers as well as for pupils since, according to them, you can increase your knowledge about languages in a fun way. Also, they reported that it was very valuable for their pedagogical work to have such a tool to implement plurilingualism in their classrooms.

In addition, the experiences with the FAQs revealed that pre-service

teachers mostly appreciated the fact that experts answered questions regarding plurilingual education and that most of these questions were worries/doubts or relatable problems in education. They reported on the usefulness the videos for their pedagogical work by saying that the videos provided them with solutions on how to deal with diversity in the classroom and inspired them to implement pupils' home languages in the classroom. Also, some pre-service teachers liked the idea of a video, so they could refer their colleagues to the videos to work together on the implementation of plurilingualism.

Lastly, the experiences with the didactical videos revealed that pre-service teachers claimed to learn considerably about the benefits of plurilingual education, ideas for plurilingual activities and that the videos contributed to fostering positive attitudes. On the one hand, these findings show that the use of digital tools in plurilingual education can contribute to fostering more positive attitudes towards linguistic and cultural diversity by engaging with a game. On the other hand, the results show that the use of digital tools for teacher professionalization supports teachers' knowledge and helps them to face certain challenges (Kirsch et al, 2020; Pozzi et al., 2016) in plurilingual education. Furthermore, it shows that technology for teacher professionalization offers a solution for teachers who do not own adequate tools and have the right skills and knowledge to integrate plurilingualism in education (see Van Laere et al, 2017).

Using Digital Games to Further Language Awareness and Openness

In response to the second research question, the data from all three instruments (i.e., the surveys, Intervention Program, and semi-structured interviews) revealed that pre-service teachers generally agree that the use of games in education can be considered an asset, which is in accordance with previous research (e.g., Klopfer, 2009). Furthermore, similar to other studies (Girard et al., 2013), participants reported that digital games in general increase the engagement of pupils and their motivation to learn. In addition, some of the pre-service teachers emphasized that they believe that when

digital games are used in the classroom, they should always be combined with other tools.

In relation to the BabelAR game, pre-service teachers from all three contexts believe that the game increases language awareness and pupils' linguistic skills. They observed that their pupils were increasingly open to learning about each other's languages and to learning new languages in general, which unconsciously raises their language awareness as they become aware of the fact that there are other languages and that one is able to speak multiple languages. This in turn would help them develop metalinguistic skills over time that are useful for their learning of both foreign and home languages (Frijns et al., 2011). In addition, participants from all three contexts agreed that the game is a suitable tool to increase teachers' language awareness, as it does not only increase overall knowledge of teachers on plurilingualism, but also raises teachers' awareness of the benefits of plurilingualism.

As research has shown (Robinson-Jones, 2020), teachers' unwillingness to integrate home languages in their lessons is often caused by a lack of knowledge on the benefits of plurilingualism and the importance of maintaining home languages. Since BabelAR reportedly increases this knowledge, it can be considered an effective tool to raise teachers' language awareness as well as to promote plurilingualism in education, as some of the participants stated that they were inspired to integrate plurilingualism in their lessons to a larger extent.

Limitations and Recommendations

It should be acknowledged that several limitations derived from the chosen design. In order to provide more in-depth conclusions and to examine the differences and similarities between the contexts in more detail, a larger sample size would be needed. Initially, this dataset was supposed to be larger and statistical tests would be conducted to see to what extent the different contexts differed and matched with respect to their attitudes before and after the use of the VirtuLApp tools. However, due to COVID-19, this study had to be adapted to the circumstances, resulting in the small sample size.

For further research, it might be interesting to include more regions

(both multilingual and monolingual) from the countries present in this study and other countries to see if differences in attitudes towards plurilingual education can be found. In addition, it will be useful to include in-service teachers and compare their attitudes towards plurilingual approaches and the use of technological tools with those of pre-service teachers. Furthermore, the effect of a plurilingual approach with the use of technological tools could also be assessed in comparison to a plurilingual approach without the use of those tools. Also, it would be interesting to investigate other factors that could influence teachers' attitudes towards plurilingual education, such as their self-perceived plurilingualism, type of language diploma, years of experience in teaching, the type of program the pre-service teachers are following and the type of subjects/knowledge on plurilingualism within their programs.

Furthermore, teachers have only been experimenting with the tools for four weeks and only a few of the participants have implemented activities/ideas in practice. In order to further investigate the impact of these tools on teachers' attitudes and knowledge of plurilingual education, it is necessary to conduct longitudinal research. It would also be interesting to investigate teachers with more experience in education to see to what extent these tools might have an impact on their attitudes and knowledge.

Conclusion

To conclude, this study revealed that pre-service teachers' attitudes towards plurilingual education can be positively influenced by using digital tools and game-based learning in education. Participants reported that the BabelAR-game stimulates pupils to learn more about languages that are unfamiliar to them and that they want to learn more about each other's languages as well. In addition, according to the pre-service teachers the game also helped them to further develop their own language awareness. Therefore, by engaging in a plurilingual game, both their language awareness and their openness towards languages is further developed, which aids them in developing metalinguistic skills over time (Frijns et al., 2011). The results further showed that by engaging with digital tools, pre-service teachers reported to become more aware of the importance of pupils' home languages in education. They also

indicated that they have more knowledge on the implementation of plurilingualism in their teaching practices due to the tools and the guidance in using these tools for educational purposes. These are important aspects in engaging with plurilingual pupils in education (Pulinx et al., 2017).

The scope of this study was reduced due to constraints related to the pandemic. Further research is needed and should include larger numbers of participants, as well as control and experimental groups to assess the circumstances under which the use of digital tools and games is successful in fostering plurilingual education. However, our results show that teacher training programs that focus on the use of digital tools are highly needed as these tools contribute to extending classroom activities and help teachers to strengthen knowledge in the field of multilingualism (Kirsch & Duarte, 2020).

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**SKAITMENINIŲ PRIEMONIŲ NAUDOJIMAS BŪSIMŲ MOKYTOJŲ
PROFESINIAM TOBULĖJIMUI SIEKIANT KALBINĖS ĮVAIROVĖS
PRADINIAME UGDYME**

Santrauka. Palaipsniui didėjant kalbų įvairovei ugdymo procese, pradinių klasių mokytojams kyla nemažai iššūkių. Ankstesnių tyrimų duomenimis, nėra daug tinkamų mokytojų rengimo programų, pagal kurias būtų rengiami mokytojai darbui kalbiškai įvairiose klasėse, todėl mokytojai, kurie moko mokinius iš įvairiomis kalbomis kalbančių šeimų, augusių įvairių kultūrų aplinkoje, yra labai priklausomi nuo jų pačių įsitraukimo į daugiakalbystę. Tai rodo, kad reikalingas pirminis pluralingvistinis (į daugiakalbystę orientuotas) būsimų mokytojų rengimas ir tęstinis mokytojų kvalifikacijos tobulinimas, kuriame daugiausia dėmesio būtų skiriama kalbinio sąmoningumo įgijimui ir kalbinės įvairovės skatinimo ir atpažinimo klasėje strategijų įgijimui. Be to, dauguma mokytojų mano, kad jiems reikia tolesnio profesinio tobulėjimo ir priemonių, padedančių valdyti ir pripažinti įvairovę klasėje. Šiame tyrime, taikant prieš-po-intervencijos tyrimo metodą, buvo nagrinėjama: a) skaitmeninių priemonių, skirtų mokytojų profesiniam tobulėjimui daugiakalbio ugdymo srityje, poveikis būsimų mokytojų nuostatoms ir žinioms; b) kaip AR-žaidimai gali būti naudojami būsimų mokytojų ir jų mokinių kalbiniam sąmoningumui ir atvirumui daugiakalbystei didinti. Dalyviai teigė, kad skaitmeninės priemonės prisidėjo prie jų žinių apie kalbinę įvairovę klasėje įgijimo, jie taip pat sužinojo naujų būdų kaip įgyvendinti daugiakalbystę savo mokymo praktikoje ir padidino jų kalbinį sąmoningumą.

Pagrindinės sąvokos: skaitmeninės priemonės; kalbinės nuostatos; kalbinis sąmoningumas; profesinis tobulėjimas; daugiakalbis ugdymas.