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COMMENTARY

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ABSTRACT

The evolution of digital technologies has frequently been hailed as a 'game-changer' in education. However, like previous technological innovations, such as television, these recent developments have failed thus far to demonstrate any significant large-scale improvement in the quality of educational provision or in educational outcomes. The papers in this special issue suggest that there is potential to change this scenario. Digital platforms such as Binogi have been able to exploit technological advances such as vastly improved crosslinguistic machine translation ushered in by artificial intelligence to make curriculum content much more accessible to multilingual students. Drawing on the papers in this special issue, I highlight three dimensions of digital learning environments that have demonstrated pedagogical credibility to enhance multilingual learners' development of literacy and their acquisition of academic content in the target language: (a) they provide extensive access to and promote engagement with written (and oral) input in the target language, (b) they provide instructional scaffolds within the digital environment to promote both awareness of how language works and intentional learning of academic concepts and subject matter content, and (c) they encourage and enable students to become autonomous learners who are capable of self-regulating and evaluating their own learning.

Over the past 60 years, multiple new technologies have been introduced to education with great expectations that their impact will transform the teaching and learning process. For example, the advent of television in the 1950s and 1960s promised to enhance and standardise the delivery of curriculum, but no large-scale improvement in educational outcomes was observed as a result of this technological innovation. In fact, research pointed to the potentially negative impact of screen time on children's literacy development. Strasburger's (1986) review of the research, for example, reported that well-controlled studies consistently demonstrated a significant negative impact on reading scores when television viewing time exceeded one hour a day. Sharif (2007) qualified this broad finding in reporting that middle school students who watched more than one hour of television on weekdays performed more poorly at school but watching up to three hours of television on weekends was not associated with underachievement.

When computers and other digital technologies arrived during the 1980s, optimistic expectations for educational transformation were revived, only to be deflated by stagnant literacy scores at a national level in most countries and research findings that, in many cases, pointed to *negative* rather than positive academic outcomes associated with computer use. Fuchs and Woessmann (2004), for example, using data involving 15-year-old students from the initial Programme for International Student Assessment (PISA) implemented by the Organisation for Economic Cooperation and Development (OECD), reported that 'the mere availability of computers at home is negatively related to student performance in math and reading, and the availability of computers at school is unrelated to student performance' (p. 17). An exception to this overall trend was the finding that the use of computers at home for accessing emails and webpages was positively related to the school performance.

This same pattern of largely negative or, at best mixed, outcomes led Cuban (2001) to characterise, in the title of his book, the status of computers in the schools at the turn of the millennium as *Oversold and Underused*. His conclusion, quoted below, still rings true 25 years later, despite the explosion of technological innovation in recent years that has transformed patterns of social interaction and access to information:

> The billions of dollars already spent on wiring, hardware, and software have established the material conditions for frequent and imaginative uses of technology to occur. Many students and teachers have acquired skills and have engaged in serious use of these technologies. Nonetheless, overall, the quantities of money and time have yet to yield even modest returns or to approach what has been promised in academic achievement, creative integration of technologies, and transformations in teaching and learning. (p. 189)

Early critics have also highlighted the diversion of scarce resources from other areas of the curriculum and pointed to the failure of virtually every technological innovation introduced to schools during the past century to improve learning in any significant way (e.g. Armstrong & Casement, 1998; Cuban, 2001; Oppenheimer, 1997, 2003).

Push-back at a policy level against the expansion of new technologies in education has recently emerged in some national contexts. For example, in September 2023, the Swedish Minister for Education, Lotta Edholm, announced plans to completely end digital learning for children under age six. Her policy reversal was supported by the conclusion of the prestigious Karolinska Institute: 'There's clear scientific evidence that digital tools impair rather than enhance student learning' (Associated Press, 2023). This conclusion is undoubtedly an overgeneralisation (as the findings reported in this special issue suggest), but scepticism regarding the expectation that digital tools will automatically transform educational provision and outcomes is reinforced by the findings of a recent meta-analysis of digital reading involving almost half a million students, conducted by Altamura et al. (2023). These authors reported that the overall positive, but minimal, impact of digital reading on reading comprehension was considerably less than what has been reported for (hard-copy) print reading. However, the impact varied according to the stage of students' educational trajectory: 'At early stages (primary and middle school) negative relationships are observed between leisure digital reading and text comprehension, while at later stages (high school and university) the relationship turns positive' (p. 1).

How should we interpret this mixed assessment of the impact of emerging digital technologies on educational attainment in light of the generally positive outcomes reported by most of the research studies of the Binogi platform in the present special issue? In the first place, it is important to note that the research reported in 2024 is predominantly qualitative in nature and does not aspire to investigate the direct impact of Binogi use on academic attainment. Additionally, this research has highlighted the complexity of implementation contexts, with significant numbers of teachers declining to invest the time and effort to become familiar with the Binogi resource in order to implement it effectively. These implementation issues reflect the fact that digital technologies are simply one component in a complex ecology of learning and teaching. Cuban (2001) expressed this point clearly in relation to schools in the United States: 'the most serious problems afflicting urban and rural poor schools – inequitable funding, extraordinary health and social needs growing out of poverty, crumbling facilities, unqualified teachers – have little to do with a lack of technology' (pp. 188-189).

Despite these complexities of implementation, the results reported in the preceding papers of this special issue do highlight the *potential* for Binogi to exert a significant transformative impact in educational contexts characterised by linguistic diversity. Binogi enables (im)migrant and refugee students to gain access to grade-level curriculum long before they would be able to do so in mainstream contexts characterised by monolingual instructional approaches and minimal use of new technologies. Specifically, the findings demonstrate that the Binogi multilingual platform *can* enhance the following teaching and learning processes:

- Access to and use of Binogi can scaffold the learning of academic content in L2 (the school language) (e.g. Alisaari et al., 2024; Auger et al., 2024; Melo-Pfeifer, 2024);
- Access to and use of Binogi involves translanguaging that can promote two-way cross-linguistic awareness and learning of academic skills in both languages (e.g. Auger et al., 2024; Le Pichon et al., 2024);
- Access to and use of Binogi in students' homes increases students' 'time-on-task' with respect to learning academic content and the school language, and also enables parents/caregivers to participate actively in supporting their children's education (e.g.; Le Pichon et al., 2024; Melo-Pfeifer, 2024);
- Access to and use of Binogi connects with students' 'funds of knowledge' (acquired from previous home and school experiences and learning opportunities), thereby facilitating learning by mobilising students' home language cognitive and academic resources in the acquisition of L2 academic and language skills (e.g. Auger et al., 2024; Le Pichon et al., 2024);
- Access to and use of Binogi affirms the relevance and value of students' linguistic and cultural experiences and identities (e.g. Cavalcante et al., 2024; Le Pichon et al., 2024);
- Access to and use of Binogi promotes students' sense of autonomy and agency in the learning process (e.g. Melo-Pfeifer, 2024).

I use the terms *can* and *has the potential* to highlight that the Binogi platform (and potentially other digital platforms not considered here) has demonstrated its potential to exert significant positive effects on academic achievement in specific contexts and under specific educational conditions. In other words, the research studies in this

special issue go some way to demonstrate *proof of concept* in relation to the pedagogical foundations of the Binogi platform.

However, the reality of educational innovation is complex, 'messy', and subject to multiple political, fiscal, organisational, and human intersections. Neil Selwyn, a professor of education at Monash University in Melbourne, Australia, made this point in relation to the recent Swedish retreat from 'full-steam-ahead' technological innovation in education: 'The Swedish government does have a valid point when saying that there is no evidence for technology improving learning, but I think that's because there is no straightforward evidence of what works with technology. … Technology is just one part of a really complex network of factors in education.' (Associated Press, 2023).

So what *does* work with technology? The failure to demonstrate impact in large-scale studies reflects the difficulties of disentangling the myriad challenges of implementation and school change from the pedagogical credibility of particular digital learning environments to promote specific learning goals under varied social and educational conditions. Pedagogical credibility can be evaluated by assessing the extent to which particular digital platforms or environments enable students to engage in learning behaviours that, according to existing research, enhance learning. For example, we know that newcomer students whose knowledge of the school language is minimal will experience difficulty in accessing the content of science and mathematics lessons delivered monolingually in the school language. If we can provide access to this content in a language students understand, and also support them in transferring this knowledge from their L1 to the school language, this constitutes a persuasive preliminary case for pedagogical credibility. Our initial research with Binogi (Le Pichon et al., 2021) suggests that multilingual students use Binogi in precisely this way. Obviously, considerably more research is required to evaluate the extent to which Binogi achieves this goal and the conditions that must be in place for this learning and crosslinguistic transfer to occur.

Similarly, there is extensive empirical documentation demonstrating the strong causal relationship between literacy engagement (e.g. reading extensively) and the development of reading comprehension (e.g. Allington & McGill-Franzen, 2021; Krashen, 2004; Lindsay, 2010, 2018). If we can provide online supports or scaffolds (e.g. bilingual and monolingual dictionaries, audio readings of texts, etc.) that enable multilingual language learners to access and understand grade-level texts in the school language at an earlier stage in their learning than is typically the case, then this digital environment has pedagogical credibility. In actual classroom practice, this credibility may or may not be realised depending on the conditions of implementation (e.g. bugs in the software, teacher resistance, etc.). In a later section, I describe a digital literacy environment that aspired to scaffold access to and engagement with target language texts in this way.

In the next section, I discuss the ways in which digital learning environments intersect with broad pedagogical goals or orientations. These pedagogical orientations reflect the educational goals that individual educators and school systems aspire to pursue and realise with their students. As such, they are simultaneously ideological and pedagogical.

Pedagogical orientations and technology

In various publications, I have described three broad orientations to pedagogy that reflect both the goals of education in particular contexts and instructional means for achieving

these goals (e.g. Cummins, 2021; Cummins et al., 2007). The three orientations – Transmission, Social Constructivist, and Transformative – are conceived as nested within each other and non-oppositional rather than stand-alone, isolated categories. There is nothing particularly novel about these distinctions, but they are often conceived as being in opposition to each other (see, for example, Cummins (2004), and Freire's (1970) description of 'banking education'). By contrast, the current formulation views each orientation as legitimate in principle. The extent to which teachers extend their instructional practice beyond transmission of curricular content into the realms of social constructivist and transformative orientations reflects their ideological conceptions regarding the purpose of education and their own identities as educators. The boundaries between these nested pedagogical orientations are not rigid or fixed and they can be seen as a continuum along which instructional practices flow, sometimes even in the course of the same lesson. This framework is described below (from Cummins, 2021) and depicted in Figure 1.

> Transmission-oriented pedagogy is represented in the inner circle with the narrowest focus. The goal is to transmit information and skills specified in curriculum directly to students. … Social constructivist pedagogy, occupying the middle pedagogical space, acknowledges the relevance of transmission of information and skills but broadens the focus to include the development among students of higher-order thinking abilities based on teachers and students co-constructing knowledge and understanding. … Finally, transformative approaches to pedagogy broaden the focus still further by emphasising the relevance not only of transmitting the curriculum and constructing knowledge but also of enabling students to gain insight into how knowledge intersects with power. Transformative pedagogy uses collaborative critical inquiry to enable students to analyse and understand the social realities of their own lives and of their communities. (p. 78)

Figure 1. Nested pedagogical orientations. Design courtesy of Vasilia Kourtis-Kazoullis and Eleni Kazoulli; reprinted with permission.

Binogi, together with many other recent applications of Artificial Intelligence (AI), clearly aims to transmit curricular content to students and thus can be characterised as transmission-oriented. However, Binogi also has the potential to extend into social constructivist and transformative orientations, depending on how teachers employ it in the classroom.[1] When used as a resource in culturally and linguistically diverse contexts, Binogi enables multilingual students to gain access to academic content (in both L1 and L2, depending on their current linguistic competencies and preference). This knowledge can then form the basis for further inquiry into issues of social relevance. For example, in the Binogi Biology module entitled 'Interaction among Species' (https://binogi.app/lesson/BIO676?grade = 858&country = US), teachers might ask students to work in groups to apply what they have learned about competition and cooperation within and between species to current international efforts to combat the destructive impact of climate change. This inquiry could be further extended in a transformative direction by asking students to analyze how power relations at national, regional, and individual levels are infused into debates about phasing out humanity's reliance on fossil fuels to generate energy.

Binogi also reduces the linguistic barriers that frequently prevent multilingual students from mobilising their (L1) cognitive and academic knowledge in the service of learning. Students can demonstrate their academic knowledge and lived experiences to teachers and peers in ways that are not possible when their home languages are excluded from the classroom. Thus, as pointed out by Le Pichon et al. (2024), multilingual digital tools such as Binogi potentially represent a significant, and even indispensable, resource for implementing culturally responsive pedagogy, as mandated in the Ontario School Curriculum. For example, the School Achievement Division (2013) of the Ontario Ministry of Education emphasised these (among other) underlying prerequisites for culturally responsive pedagogy:

- **Constructivist approach:** 'Culturally responsive educators build upon the varied lived experiences of all students in order to bring the curriculum to life' (p. 5).
- **Deep knowledge of their students:** 'Deep knowledge, not just of content, but of one's students as individual learners, enables educators to integrate lived experiences into the daily learning of the classroom' (p. 5).
- **Culturally responsive teaching practices:** 'At the core of these strategies is a) holding high expectations for learning while b) recognising and honouring the strengths that a student's lived experiences and/or home culture bring to the learning environment of the classroom' (p. 6).

The Ministry document (p. 7) goes on to quote Villegas and Lucas (2002, p. 25) who argue that '[t]he knowledge children bring to school, derived from personal and cultural experiences, is central to their learning. To overlook this resource is to deny children access to the knowledge construction process'.

Binogi potentially advances these culturally responsive pedagogical aspirations in significant ways. By incorporating multiple languages spoken by newcomer multilingual students into the instructional process, Binogi enables students to express their lived experiences and showcase their academic funds of knowledge. As suggested by Le Pichon et al. (2024), it is clearly problematic to emphasise the relevance of the knowledge

and lived experiences students bring to school while implicitly excluding the languages in which these lived experiences and cultural knowledge are encoded. Binogi enables teachers to implement culturally responsive pedagogy in a deeper and more inclusive way by providing multilingual tools that students can use to activate and share their cognitive and academic strengths within the classroom.

Binogi can also be characterised as embodying transformative orientations to pedagogy by virtue of its challenge to and implicit repudiation of monolingual instructional ideologies in multilingual educational contexts. Several of the papers in this special issue describe the ambivalence and even reluctance of some teachers to make use of Binogi's multilingual resources. For example, Alisaari et al. (2024) describe how monolingual ideologies persisted among many Finnish preservice teachers even after exposure to Binogi and elaboration of ways in which multilingual students' L1 could serve as a resource for learning L2 and academic content. This ideology is clearly expressed by one participant: 'The language of instruction is Finnish, and every moment is a moment to learn Finnish'. Similar resistance to the use of students' L1 in the school by some parents has been noted by Le Pichon et al. (2024).

This 'maximum exposure' assumption has been refuted by hundreds of research studies conducted since the 1970s. The National Academies of Sciences, Engineering and Medicine (NASEM) in the United States expressed this research consensus as follows:

> Conclusion 6-3: The languages of bilinguals do not develop in isolation from one another. Evidence indicates that certain aspects of dual language learning, processing, and usage are significantly and positively correlated and that the development of strong L1 skills supports the development of English-L2 skills. …

> Conclusion 6-4: Evidence reveals significant positive correlations between literacy skills in ELs' [English learners'] L1 and the development of literacy skills in English-L2. Educational programs that provide systematic support for the development of ELs' L1 often facilitate and enhance their development of skills in English, especially literacy. (2017, p. 245)

These findings are based predominantly on the outcomes of bilingual programmes that promoted literacy in both the school language and minority students' L1 (or heritage language). However, over the past 30 years (since the mid-1990s), educators and researchers have demonstrated that positive outcomes can also result when these findings about L1/L2 relationships are applied in the context of multilingual classrooms involving students from multiple language backgrounds. In these contexts, bilingual programmes are not feasible, but creative educators have identified and tested powerful instructional strategies to enable students to build on and extend their multilingual abilities in learning the school language and academic content (for reviews, see Auger & Le Pichon-Vorstman, 2021; Cummins, 2021). The *Language Friendly Schools* movement (Le Pichon & Kambel, 2022), described by Le Pichon et al. (2024), has built on the experiences and outcomes of current and earlier case studies (e.g. Carbonara & Scibetta, 2020; Cummins & Early, 2011; Little & Kirwin, 2019) and has created an international community of schools that are implementing a wide range of multilingual instructional initiatives. The feasibility and ease of implementing powerful multilingual pedagogies has also increased significantly as a result of new technologies ranging from translation software (e.g. Google Translate) to the multilingual curriculum content developed by Binogi.

These new technologies have increased access to multilingual children's books (e.g. https://globalstorybooks.net/), facilitated the writing and dissemination of dual language books and projects written by multilingual learners (e.g. Anderson & Macleroy, 2016; Cummins & Early, 2011; Prasad & Lory, 2020), and amplified the scope and impact of partner-class networks focused on collaborative critical inquiry involving multilingual students (e.g. Anderson & Macleroy, 2016; Cummins et al., 2007). All of these initiatives, including Binogi, collectively reflect what Walker (2014) has called *pedagogies for powerful communication*, and they illustrate the potential for new technologies to act as amplifiers of student learning. Thus, when emerging digital technologies are harnessed to appropriate pedagogical goals, they are clearly capable of promoting *literacy-friendly pedagogy* in addition to facilitating and promoting language-friendly pedagogy. An example of how new technologies can promote literacy-friendly pedagogy is described in the next section.

Literacy-friendly pedagogy and technology

The e-Lective Language Learning programme was an electronic environment designed by Jim Cummins (in Canada) and programmed by Sotirios Chascas (in Greece) to enable immigrant background students who are learning the language of instruction to access the meaning of academic texts that are beyond their current level of target language proficiency. It was also designed to extend all students' knowledge of academic language by means of extensive reading. The rationale for the programme derives from the fact that as students progress through the grades from elementary into secondary school, development of academic language proficiency *requires* that they get extensive access to, and be enabled to harvest, the language of academic text. The low-frequency and academic language vocabulary that becomes increasingly central to reading comprehension as students progress through the grades is found predominantly in written text. As noted previously, there is an extensive body of research evidence demonstrating a significant causal relationship between the volume of reading carried out by students and the development of both vocabulary knowledge and reading comprehension (see Allington & McGill-Franzen, 2021; and Cummins, 2021, for reviews). The programme was described as follows by Cummins et al. (2008):

> Any text in electronic form can be imported into the e-Lective program and students can get rapid access to first language (L1) and English dictionary support to facilitate understanding of the meaning of individual words and sentences. In addition, the program 'remembers' the words that each individual student has looked up (unknown words) and provides individualized practice for students to assist them in learning this vocabulary. These practice exercises employ a variety of receptive and productive cloze procedures and can be set at five levels of difficulty. For example, the *Blank Words* procedure blanks out the words the student looked up and then students select the correct word from a set of alternatives. The difficulty level, which can be adjusted by teachers or students, determines the number of words from which students select. The *Partial Words* procedure blanks out part of the unknown word and students type the entire word into a pop-up box. The program gives immediate feedback as to the correctness of the choice or spelling of the word. The difficulty scale determines the proportion of letters (ranging from 10%–90%) that are deleted from the word. (pp. 9-10)

Figure 2 shows the Partial Words procedure (with difficulty set at level 3 on a 5-point scale). The text is Henry Thoreau's essay *On the Duty of Civil Disobedience*. The student
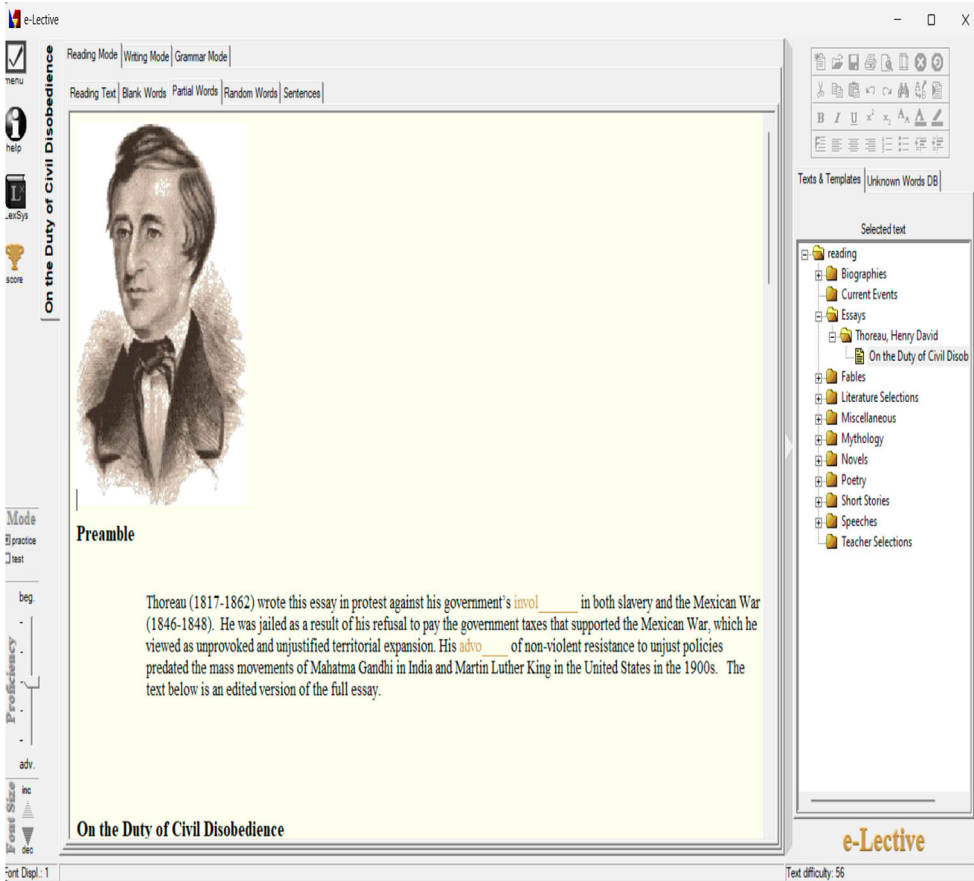
Figure 2. Screen shot from e-Lective Language Learning programme.

in this example has looked up the meaning of the (unknown) words *involvement* and *advocacy*. The Practice/Test procedure has blanked out 50% of the letters in these words and students must write the entire word in the pop-up box.

Other features of the programme include the ability for the teacher or student to immediately identify in any text all the high-frequency words typically used in face-to-face conversational contexts (e.g. time, something, work, etc.), general academic words that commonly occur across multiple academic disciplines (e.g. examine, inquire, design, etc.), and low-frequency specialised academic words (e.g. molecule, genome, photosynthesis). These categories correspond to Tier 1, 2, and 3 vocabulary discussed by Beck et al. (2008).

Students' progress in learning the vocabulary they encounter in the texts they read can be tracked by teachers or the students themselves. Students demonstrate that they have learned previously unknown words by passing a 'test' at difficulty level 3 or above (on the five-point scale). The tests employ the same cloze procedures used in Practice Mode but provide feedback only after completion of the entire test. The system tracks students' progress in transforming previously unknown words into 'learned words'. On the basis of the tracking information on students' reading progress, teachers could make statements such

as: *Maria read 8 texts during October containing 4,020 words. Of these words, 483 were originally unknown to her but, over the course of the month, she demonstrated that she had learned 400 of these new words. The 83 words that Maria did not know and has not yet demonstrated knowledge of are listed below.*

The e-Lective programme was conceived and developed between 1996 and 2010 (Cummins, 1998, 2002). It was used successfully in research contexts (e.g. Cummins et al., 2008), but for a variety of reasons (e.g. absence of funding) it was never commercialised or implemented widely in schools. Although features such as audio read-alouds and online dictionary support are now commonplace in electronic texts, one of the most powerful functionalities for learning, namely the use of cloze procedures to enable learners to practice their learning of previously unknown words, and also to test their knowledge of these words, has not been replicated in any current programme that I am aware of. The cloze-based Practice and Self-Testing functionalities can be adjusted by the learner for difficulty level, thereby supporting learner autonomy even for early stage learners (Little, 2020). Many, but not all, of the functionalities built into the programme are available in much more accessible forms today, but they nevertheless illustrate the potential of emerging technologies to promote literacy-friendly pedagogies in addition to language-friendly pedagogies.

Conclusion

In order to wrap up this commentary, we can return to the question that forms the title: 'How can emerging technologies advance the creation of language-friendly and literacy-friendly schools?' Although the terms are intuitively transparent, it is useful to state more explicitly my understanding of what constitutes language-friendly and literacy-friendly schools. Drawing on the description outlined at the Language Friendly School website (www.languagefriendlyschool.org), the vision of the language-friendly schools movement can be characterised as follows:

> As educators, we should be working as a whole school community to transform our schools into language-friendly ecosystems where (a) students' languages are recognized and affirmed, (b) all students can expand their identities as they become aware of how language works in our heads, our families, and our societies, and (c) students can begin to use their entire multilingual repertoire for powerful (identity-affirming) purposes.

A literacy-friendly school can be described as follows:

> A literacy-friendly school (or preschool) ensures that all students are immersed in a print-rich environment from the earliest stages of their schooling. In the early grades, they experience daily opportunities to listen to stories, poetry/songs, and other forms of text being read aloud by the teacher or other adults. During the course of these read-alouds, the teacher draws students' attention to various aspects of the written text and how it relates to the spoken language. Students are also taught explicitly and systematically in small-group or whole-class mini-lessons to pay attention to how spoken and written language relate to each other and are given opportunities to explore these relationships through their own writing. Students are encouraged to develop a strong motivation to engage with books of multiple genres both in the school and in their homes. Multilingual and/or newcomer students who are learning the school language are supported in their efforts to read and write that language by encouraging continued development of their L1, transfer of L1 conceptual and literacy-related knowledge to L2,

and through the use of the dynamic and individualized supports that can be embedded in digital texts.

The 'Proverbs Project' conducted within one of the first Internet-mediated global learning networks entitled *De Orilla a Orilla* (From Shore to Shore), initiated and coordinated by Kristin Brown and Dennis Sayers starting in the 1980s, illustrates both language-friendly and literacy-friendly pedagogical orientations. The following sketch of this project is paraphrased from Cummins et al. (2007, pp. 118–119):

> For more than a decade, primary and secondary students from dozens of countries around the world collected proverbs from parents, family, and friends, and organized, analyzed, and eventually shared and compared their multilingual collections with those of distant students in other *Orillas* classrooms using technology at every stage of the project. The project proved popular among parents and extended families because the younger generation would eagerly seek out from them the kind of folk knowledge that had been passed down over many years and decades from previous generations.

As noted previously, digital technologies represent powerful amplifiers for cultural and linguistic exchange across linguistic and national boundaries (Anderson & Macleroy, 2016). These projects frequently span the range of pedagogical orientations, from transmission through social constructivist to transformative, and they are almost by definition both language-friendly and literacy-friendly as described above.

However, the pedagogical credibility of technology is not limited to the enhancement of free-flowing linguistic and cultural exchanges made possible by the Internet. More structured and narrowly focused technological innovations, such as Binogi and e-Lective Language Learning, incorporate instructional scaffolds that facilitate the learning of language, literacy, and academic content in ways that potentially go far beyond what is possible in typical classrooms using only textbooks and other hard-copy print materials. Although these digital platforms and programmes are intended for use with all students, their potential to enhance learning is particularly evident in the case of multilingual students who are learning the language of instruction. The following three core dimensions are central to the pedagogical credibility of these applications for multilingual learners:

- They provide extensive access to and promote engagement with written (and oral) input in the target language.
- They provide linguistic and other instructional scaffolds within the digital environment to promote both awareness of how language works and intentional learning of academic concepts and subject matter content.
- They encourage and enable students to become autonomous learners who are capable of self-regulating and evaluating their own learning.

According to Little (2022) ''language learner autonomy' denotes a teaching/learning dynamic in which learners plan, implement, monitor and evaluate their own learning' (p. 64). When teachers value and encourage multilingual students' sense of autonomy and agency and use technologies with pedagogical credibility to facilitate this process, as was the case for Teacher 1 in Melo-Pfeifer's research (this volume), it is not difficult to envisage an emerging instructional landscape where newcomer multilingual students move from identities of incomprehension and incompetence in the learning process to

identities of confidence and competence (Manyak, 2004). As demonstrated by the papers in this special issue, digital platforms such as Binogi have the pedagogical credibility to advance this process significantly, despite the very real challenges of implementation in complex educational contexts.

Note

1. The ESCAPE project (www.escapeprojects.ca), described by Le Pichon et al. (2024) has developed illustrative lesson plans for 12 of the Binogi modules (six Science, six Math) intended to support teachers in creating social constructivist inquiry-based lessons that supplement the curriculum content included in the Binogi module. These lesson plans also incorporate both language-friendly and culturally responsive pedagogies.

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References

Alisaari, J., Heikkola, L. M., & Harju-Autti, R. (2024). Finnish pre-service teachers' understandings of the role of language(s) in learning mathematics. *Language, Culture and Curriculum*, *37*, https://doi.org/10.1080/07908318.2023.2258156

Allington, R. L., & McGill-Franzen, A. M. (2021). Reading volume and Reading achievement: A review of recent research. *Reading Research Quarterly*, *56*(S1), S231–S238. https://doi.org/10.1002/rrq.404

Altamura, L., Vargas, C., & Salmerón, L. (2023). Do new forms of Reading pay off? A meta-analysis on the relationship between leisure digital Reading habits and text comprehension. *Review of Educational Research*, 1–36. https://doi.org/10.3102/00346543231216463

Anderson, J., & Macleroy, V. (2016). *Multilingual digital storytelling: Engaging creatively and critically with literacy*. Routledge.

Armstrong, A., & Casement, C. (1998). *The child and the machine: Why computers may put our children's education at risk*. Key Porter Books.

Associated Press. (2023, 11 September). Switching off: Sweden says back-to-basics schooling works on paper. *The Guardian*. https://www.theguardian.com/world/2023/sep/11/sweden-says-back-to-basics-schooling-works-on-paper.

Auger, N., & Le Pichon-Vorstman, E. (2021). *Défis et richesses des classes multilingues. Construire des ponts entre les cultures*. ESF Sciences Humaines.

Auger, N., Sauvage, J., Le Pichon-Vorstman, E., Fleuret, C., Adegbonmire, L., & Dalle, L. (2024). Multilingual pedagogies and digital technologies to support learning STEM in schools in France and Canada. *Language, Culture and Curriculum*, *37*, https://doi.org/10.1080/07908318.2023.2269977

Beck, I. L., McKeown, M. G., & Kucan, L. (2008). *Creating robust vocabulary: Frequently asked questions and extended examples*. Guildford Press.

Carbonara, V., & Scibetta, A. (2020). *Imparare attraverso le lingue: Il translanguaging come pratica didattica*. [Learning across languages: Translanguaging as a teaching practice] Carocci Editore.

Cavalcante, A., Gagné, A., & Le Pichon-Vorstman, E. (2024). Mathematical benefits of a language-friendly pedagogical tool: A praxeological analysis of teachers' perceptions and practices. *Language, Culture and Curriculum*, *37*, https://doi.org/10.1080/07908318.2023.2265407

Cuban, L. (2001). *Oversold and underused: Computers in the schools*. Harvard University Press.

Cummins, J. (1998, Spring). e-Lective language learning: Design of a computer-assisted text-based ESL/EFL learning system. *TESOL Journal*, 18–21.

Cummins, J. (2002). *Learning through target language texts*. In K. Nakajima (Ed.), *Learning Japanese in the network society* (pp. 105–122). University of Calgary Press.

Cummins, J. (2004). Using IT to create a zone of proximal development for academic language learning: A critical perspective on trends and possibilities. In C. Davison (Ed.), *Information technology and innovation in language education* (pp. 105–126). Hong Kong University Press.

Cummins, J. (2021). *Rethinking the education of multilingual learners: A critical analysis of theoretical concepts*. Multilingual Matters.

Cummins, J., Ardeshiri, M., & Cohen, S. (2008). Computer-supported scaffolding of literacy development. *Pedagogies: An International Journal*, *3*(1), 4–21. https://doi.org/10.1080/15544800701771572

Cummins, J., Brown, K., & Sayers, D. (2007). *Literacy, technology, and diversity: Teaching for success in changing times*. Pearson Education.

Cummins, J., & Early, M. eds (2011). *Identity texts: The collaborative creation of power in multilingual schools*. Trentham Books.

Freire, P. (1970). Pedagogy of the oppressed. *Continuum*.

Fuchs, T., & Woessmann, L. (2004). Computers and students learning: Bivariate and multivariate evidence on the availability and use of computers at home and at school. *CESIFO Working Paper*, No. 1321. https://www.econstor.eu/dspace/bitstream/10419/18686/1/cesifo1_wp1321.pdf.

Krashen, S. D. (2004). *The power of Reading: Insights from the research*. Heinemann.

Le Pichon, E., Cummins, J., & Vorstman, J. (2021). Using a web- based multilingual platform to support elementary refugee students in mathematics. *Journal of Multilingual and Multicultural Development*.

Le Pichon, E., & Kambel, E.-R. (2022). The Language Friendly School: An inclusive and equitable pedagogy. *Childhood Education*, *98*(1), 42–49. https://doi.org/10.1080/00094056.2022.2020538

Le Pichon, E., Wattar, D., Naji, M., Cha, H. R., Jia, Y., & Tariq, K. (2024). Towards linguistically and culturally responsive curricula: The potential of reciprocal knowledge in STEM education. *Language, Culture and Curriculum*, *37*, https://doi.org/10.1080/07908318.2023.2221895

Lindsay, J. (2010). *Children's access to print material and education-related outcomes: Findings from a meta-analytic review*. Learning Point Associates.

Lindsay, J. J. (2018). Interventions that increase children's access to print material and improve their Reading proficiencies. In R. L. Allington, & A. McGill-Franzen (Eds.), *Summer Reading: Closing the rich/poor Reading achievement gap* (pp. 41–58). Teachers College Press.

Little, D. (2022). Language learner autonomy: Rethinking language teaching. *Language Teaching*, *55* (1), 64–73. https://doi.org/10.1017/S0261444820000488

Little, D, & Kirwin, D. (2019). *Engaging with linguistic diversity*. Bloomsbury Academic.

Manyak, P. C. (2004). 'What did she say?' Translation in a primary-grade English immersion class. *Multicultural Perspectives*, *6*(1), 12–18. https://doi.org/10.1207/S15327892mcp0601_3

Melo-Pfeifer, S. (2024). Crossing linguistic and disciplinary boundaries? Linguistic practices in STEM/ S.T.E.M. classrooms, or how a multilingual habit does not make a multilingual monk. *Language, Culture and Curriculum*, *37*, https://doi.org/10.1080/07908318.2023.2232389

National Academies of Sciences, Engineering and Medicine (NASEM). (2017). *Promoting the educational success of children and youth learning English: Promising futures*. The National Academies Press. https://doi.org/10.17226/24677.

Oppenheimer, T. (1997). The computer delusion. *The Atlantic Monthly*, *280*(1), 45–62.

Oppenheimer, T. (2003). *The flickering mind: The false promise of technology in the classroom, and how learning can be saved*. Syndetic Solutions Inc.

Prasad, G., & Lory, M.-P. (2020). Linguistic and cultural collaboration in schools: Reconciling majority and minoritized language users. *TESOL Quarterly*, *54*(4), 797–822. https://doi.org/10.1002/tesq.560

School Achievement Division. (2013, November). Culturally responsive pedagogy: Towards equity and inclusivity in Ontario schools. Capacity Building Series K-12. Ontario Ministry of Education. https://www2.yrdsb.ca/sites/default/files/migrate/files/cbs_responsivepedagogy.pdf.

Sharif, I. (2007, May). Does watching television affect school performance? *Pediatrics for Parents*, *23* (5), 5.

Strasburger, V. C. (1986). Does television affect learning and school performance? *Pediatrician*, *13*(2-3), 141–147.

Villegas, A. M., & Lucas, T. (2002). Preparing culturally responsive teachers: Rethinking the curriculum. *Journal of Teacher Education*, *53*(1), 20–32. https://doi.org/10.1177/0022487102053001003

Walker, D. (2014). *A pedagogy of powerful communication: Youth radio and radio arts in the multilingual classroom*. Peter Lang.