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The Use of Interactive Whiteboards to Support Refugee Learning

A rapid scan of research and best practices in Turkey and the MENA region

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Abbreviations and acronyms

ASD	Autistic spectrum disorder
EBA	Eğitim Bilişim Ağı (Education Information Network)
EFL	English as a foreign language
ESL	English as a second language
FATİH	Fırsatları Artırma ve Teknolojiyi İyileştirme Hareket (Movement to Enhance Opportunities and Improve Technology)
FCDO	Foreign, Commonwealth and Development Office
ICT	Information and communications technology
IRPAL	Islamic Relief Palestine
IWB	Interactive whiteboard
LMIC	Low- and middle-income country
MENA	Middle East and North Africa
MoNE	Ministry of National Education
SEND	Special educational needs and disabilities
TAM	Technology Acceptance Model
TPD	Teacher professional development
UNHCR	United Nations High Commissioner for Refugees
UNRWA	United Nations Relief and Works Agency

Executive summary

This report provides a rapid overview of the use, impact, and implications of interactive whiteboards (IWBs) in educational settings globally, with a particular focus on their application in low- and middle-income countries (LMICs), the MENA region, and among refugee learners. It synthesises findings from global and national initiatives, including Turkey's FATİH[1] project and Senegal's Project Sankoré, as well as from smaller-scale efforts in Botswana, Jordan, and Kuwait, among others.

IWBs are interactive display tools that combine projection, touch responsiveness, and specialised software to support dynamic, multisensory teaching. Their functionalities — such as annotation, multimedia integration, real-time feedback, and networked collaboration — enable flexible and engaging instruction for diverse learners. Integration with tablets, document cameras, and online resources further enhances their pedagogical potential.

IWBs have seen widespread adoption globally, particularly in high-income countries like Australia and the UK, and increasingly in LMICs such as Jordan and Mexico. Turkey's FATİH project remains one of the largest national EdTech rollouts in the world, demonstrating positive impacts on engagement and achievement, particularly in visual and auditory learning contexts. In the MENA region, IWBs are being used to support instruction in Arabic and English as a foreign language (EFL), often enhancing student motivation and comprehension.

This rapid scan highlights that IWBs can enhance student engagement, motivation, and multimodal learning. Their effectiveness, however, is heavily dependent on teacher training, contextual integration, and ongoing technical and pedagogical support. While IWBs offer potential for inclusive education, particularly for learners with special educational needs and disabilities (SEND), they are not inherently transformative and often fail to improve outcomes when used without clear pedagogical intent. Evidence on the use of IWBs with refugee learners remains limited, but promising. The United Nations Relief and Works Agency's (UNRWA) recent procurement of IWBs signals growing interest, and studies suggest IWBs can aid language learning, for example, when integrated into Arabic and EFL instruction. However, challenges such as insufficient training, unclear ownership, underutilisation of equipment, and inadequate infrastructure remain critical barriers.

[1] FATİH stands for 'Fırsatları Artırma ve Teknolojiyi İyileştirme Hareket', which translates as 'Movement to Enhance Opportunities and Improve Technology'.

This rapid scan presents considerations for education and EdTech decision-makers who want to learn more about the use of IWBs, for example:

- Training for the use of IWBs should not only focus on hardware operation but also on pedagogical strategies aligned with literacy, numeracy, and curriculum goals.
- Infrastructure readiness, including technical support and clear handover structures, is essential to avoid hardware underutilisation.
- User needs and contextual realities must shape programme design; isolated tech rollouts without teacher input or support often fail.
- Content alignment with national curricula and accessible digital resources is vital for successful classroom integration.

There is a critical need for rigorous, large-scale studies that measure the impact of IWBs on student learning outcomes, particularly in LMICs and refugee settings. Current research is heavily skewed towards engagement metrics in high-income contexts. While IWBs hold significant potential to enhance instruction and engagement, their success depends on thoughtful implementation, context-specific planning, and long-term investment in teacher capacity and system infrastructure.

1. About this rapid scan

The UK's Foreign Commonwealth and Development Office's (FCDO) Middle East and North Africa (MENA) Regional Department (MRD) requested a rapid scan outlining the efficacy[2] of interactive whiteboards (IWBs) to better understand the potential impact of investment in the digitisation of teaching and learning materials to enhance access to education and learning for refugee children. The FCDO is interested in understanding the various factors that affect the efficacy of IWBs. The focus is on research that can highlight any evidence on the efficacy of interactive whiteboards in low- and middle-income country (LMIC) contexts characterised by high numbers of school-age refugees.

Furthermore, in light of significant investment in IWBs by Turkey's Ministry of National Education (MoNE), this scan pays particular attention to the Turkish context. In 2024, 84.31% of classrooms in Turkey had IWBs, increasing to 87.15% across earthquake-affected provinces.[3] The ministry's investment in IWBs presents an opportunity to learn from Turkey and better understand what lessons can be replicated for further investment in the MENA region as a whole.

In response to the FCDO's request, the EdTech Hub Helpdesk developed this rapid scan on IWBs, with Turkey as a key case study, and it presents global evidence on the efficacy and use of IWBs in low-resource and refugee settings. In addition to Turkey, the authors examined evidence from the use of IWBs in other refugee and education in emergencies (EiE) contexts, as well as available reports from LMIC contexts. These reports highlight important and valid considerations that can be applied to broader learnings around IWBs.

Studies reviewed for this scan:

- relate to primary school learners, with some studies including secondary school learners;
- were published primarily between 2010 and 2025;

[2] 'Efficacy of IWBs' here refers to teacher engagement with and uptake of IWBs, student motivation and engagement with IWBs, and positive learning outcomes for students.

[3] These figures are taken from an internal document shared by UNICEF with the Hub team, which cites an internal MoNE 2025 document on innovation and education technologies.

- contain either quantitative or qualitative evidence related to the use of IWBs;
- mainly focus on countries classified as low- or lower-middle income (given the lack of evaluations on the use of IWBs from many LMICs, the scan also pulled lessons learnt and evidence from some middle- to high-income countries);
- are in English (two Turkish language and three Arabic language reports are also highlighted).

The rapid scan has three fundamental limitations, stemming from the rapid scan time frame and the nature of available evidence. These include:

1. **Search and inclusion strategy:** An inherent limitation of the rapid scan is that the search and inclusion strategy is, by design, not exhaustive. Given that the scan focused heavily on snowball sampling, the search for grey literature is less rigorous, since it is not possible to use formal search strings in a standard Google search. Hence, some sources may have been missed.
2. **Reliance on documents primarily presented in English:** Due primarily to time constraints, we were only able to search for documents in English. Some resources included in our search are also available in multiple languages, but we were only able to analyse those available in English or those for which translations could be completed within a short time frame.
3. **Short time frame:** The rapid scan was completed over a span of three weeks, owing to the urgency of the request. This means that some sources may have been missed.

2. An introduction to IWBs as a resource tool

IWBs are innovative technology tools that can enhance traditional classroom learning by creating more engaging and dynamic learning experiences (↑Masnun et al., 2025; ↑Olaimat et al., 2022). IWBs incorporate large, touch-responsive electronic displays connected to a computer and a projector, allowing users to view and interact with the computer's content, including audio and video (↑Hennessy & London, 2013). IWBs are often accompanied by specialised software that mimics flipcharts and blackboards — supporting teachers in lesson planning, student engagement, and even handwriting correction (↑Luo et al., 2023; ↑Masnun et al., 2025).

2.1. Key features

IWBs support a range of features which allow users to annotate, highlight, draw, zoom, hide, reveal, and move digital content on their screens. Modern models have multitouch functionality, allowing multiple users to interact with the IWB simultaneously (↑Hennessy & London, 2013; ↑O'Donnell, 2015). They can support a variety of teaching styles through the use of visual aids, animation, videos, and surveys to allow for real-time feedback (↑Erdener, 2021; ↑Masnun et al., 2025). IWBs can also provide access to online resources and allow users to store and share lesson materials. Any manipulation of content can be saved to revisit at a later time, improving lesson continuity and efficiency (↑Erdener, 2021; ↑Luo et al., 2023; ↑Tunaboylu & Demir, 2016).

In networked classrooms where IWBs are integrated with student tablets, teachers can monitor student activity and display tablet screens centrally on the IWB, fostering further collaborative and adaptive learning environments (↑Ishtaiwa & Shana, 2011). IWBs can also be connected to document cameras and clickers to allow users to present physical materials digitally and engage from different parts of the classroom (↑Hennessy & London, 2013; ↑Moss et al., 2007).

2.2. Key benefits

IWBs have seen widespread global adoption in classrooms, with around Given the variety of features of IWBs and the teaching and learning styles they support, IWBs can help teachers streamline lesson planning and delivery, access and share a range of multimedia resources, and customise

lessons to specific classroom needs (↑Ishtaiwa & Shana, 2011; ↑Masnun et al., 2025). Through technical and pedagogical interactivity, IWBs can foster student participation, peer learning, and active discussion (↑Ishtaiwa & Shana, 2011; ↑Tsayang et al., 2020). They can significantly boost student engagement and motivation by making lessons more interactive and multisensory—catering to visual, auditory, and kinesthetic learners (↑Drigas & Papanastasiou, 2014; ↑Ishtaiwa & Shana, 2011; ↑Hennessy & London, 2013).

While IWBs can provide a multitude of benefits, their effectiveness largely relies on sufficient teacher training, appropriate technical support, and the application of pedagogical strategies (↑Alhumsi, 2024; ↑Drigas & Papanastasiou, 2014; ↑Higgins et al., 2007; ↑Masnun et al., 2025). To fully harness the key benefits of IWBs for interactive learning, teachers need to use them not merely as large displays, but meaningfully integrate them into their teaching content and practices (↑Alghamdi, 2018; ↑Hennessy & London, 2013; ↑Lehrer et al., 2019; ↑Luo et al., 2023; ↑Masnun et al., 2025).

2.3. A snapshot of the global use of IWBs

IWBs have seen widespread global adoption in classrooms, with around one in every eight classrooms worldwide by 2012 (equivalent to 34 million classrooms) (↑Hennessy & London, 2013). In 2012, the UK had the highest uptake, with over 80% classroom penetration (↑Hennessy & London, 2013). However, updated official statistics have not been available amid the mandatory replacement of old IWBs.

Countries, including Italy and Turkey, have been implementing large-scale projects to provide all classrooms with IWBs and other high-tech educational tools (↑Saltan, 2019). Turkey has experienced one of the fastest global growth rates in IWB adoption through its five-year FATİH project (Fırsatları Artırma ve Teknolojiyi İyileştirme Hareketi, which translates as 'Movement to Enhance Opportunities and Improve Technology'), launched in 2012 (↑Bathanti & Abdul-Hamid, 2023). The initiative aimed to equip 620,000 classrooms with IWBs and distribute tablets to all teachers and students, with a transition goal of a computer in every school to a computer in every classroom. By 2015, over 101,000 IWBs had already been installed in 41,996 schools (↑Hennessy & London, 2013; ↑Tunaboylu & Demir, 2016), and by 2025, over 626,441 IWBs had been installed in 742,829 classrooms. Given the high number of refugee learners in Turkey and the government's significant investment in IWBs across the country, it will feature as a prominent case study throughout this report.

Other countries with high usage include Denmark, the Netherlands, and Australia (with an IWB in every other classroom [↑Hennessy & London, 2013; ↑O'Donnell, 2015; ↑Saltan, 2019]), and the US, where 41% of schools had IWBs by 2012 (↑Hennessy & London, 2013). Countries including China, Japan, Malaysia, Mexico, Russia, Singapore, and Taiwan are actively pursuing IWB integration (↑Hennessy & London, 2013; ↑Luo et al., 2023; ↑Saltan, 2019). Mexico alone has introduced IWBs in over 170,000 primary classrooms, following an initial push which began in 2004 (↑Hennessy & London, 2013).

2.3.1. Adoption in low- and middle-income countries (LMICs)

In Jordan, competition in the education sector encourages schools to adopt advanced technologies to enhance learning experiences, and private schools have been rapidly adopting IWBs (↑Abuhmaid, 2014). This growth has been evident since the launch of the 2009 Jordan Initiative (↑Olaimat et al., 2022), which fostered public–private partnerships to bolster institutional capacity and promote innovation by embedding technologies into teaching and learning processes.

In public schools within the Balqa Governorate of Jordan (↑Olaimat et al., 2022), IWBs are reported as the most commonly used technological teaching tool across all subjects and education levels. IWBs have also proven beneficial for supporting language acquisition for Arabic and English as a foreign language (EFL). For Arabic instruction, and specifically for the Nahwu syntax (↑Masnun et al., 2025), IWBs have helped improve visual and auditory engagement, correct basic Arabic letter formation, and quickly disseminate information in schools in Jordan (↑Olaimat et al., 2022). EFL teachers in Jordan (↑Alhumsi, 2024) reported favourable experiences using IWBs to improve their students' word identification skills, enjoyment, and participation in lessons. The use of visual imagery in lessons increased student motivation, memory, and vocabulary. Additional examples of the benefits of using IWBs and an overview of learning outcomes from the MENA region are highlighted in Section 4.4.5.

In Botswana, the SMART Technologies Pilot Project launched in 2012 (↑Tsayang et al., 2020) has been providing IWBs and accompanying technology to five strategically selected schools for integration into instruction across select subjects.[4] Teachers selected for participation received professional development through targeted workshops before delivering instruction with IWBs and guiding students on how to use

[4] Select subjects were chemistry, computer education, integrated science, mathematics, physics, social studies, and special education.

them. ↑Tsayang et al. (2020) found that the IWBs addressed cognitive, affective, and psychomotor learning domains aligned with Botswana's education system, which aims to move away from rote memorisation and limited student participation.

Project Sankoré (see Figure 1 below), based in Senegal (↑Lehrer et al., 2019), also distributed IWBs and saw overall positive outcomes, although many IWBs were underutilised over time.

Figure 1: *Project Sankoré: An IWB implementation case study from Senegal* (↑Lehrer et al., 2019)

The Sankoré project was initiated as part of a donor-funded collaboration between the French government and seven participating countries: Benin, Burkina Faso, Haiti, Madagascar, Mali, Mauritius, and Senegal. The project involved the distribution of kits that included a computer, a video projector, and an IWB equipped with smart touch technology. In addition, it offered access to educational content through *Open-Sankoré* — a multi-platform, open-source portal that could be used even without continuous internet access.

Although the project demonstrated overall positive outcomes, particularly in terms of improved student learning, these gains were primarily observed in urban settings. Several factors contributed to this disparity between urban and rural areas, including differences in baseline digital literacy, availability of EdTech infrastructure, and teacher capacity to use EdTech in their lesson planning and delivery. A significant issue was the delay in teacher training; in many cases, training occurred up to seven months after the equipment had been delivered. Furthermore, while teachers were trained, school leaders often were not, which limited the level of support and supervision available to educators. In addition, frequent teacher transfers (untrained teachers were sometimes relocated to schools equipped with IWBs) resulted in underutilisation of the technology.

The initial training offered to both teachers and school leaders focused narrowly on hardware usage and lasted only two to three days per school year. This short duration was widely regarded as insufficient during programme evaluations.

Despite these challenges, the programme's strengths were widely acknowledged. One of the most frequently cited benefits was its motivational impact on both teachers and students. Of the 244 coded responses highlighting programme strengths, 45.5% related to motivation — a sentiment shared across all respondent groups. This motivational effect was attributed to features such as time-saving tools, visual aids, enhanced comprehension, and support for concept formation. Teachers noted that the availability of ready-made content within the kit significantly reduced their lesson preparation time. In the classroom, the use of visual content helped students grasp concepts more quickly, thereby improving lesson pacing and enabling broader coverage of the curriculum.

3. IWBs to support refugee learning

IWBs have been used to support learning in contexts specifically involving refugee populations in very few documented instances, with some documentation in UNRWA schools. In 2023 and 2024, UNRWA issued tenders for interactive whiteboards and flat panels, indicating a move toward equipping classrooms with IWBs in its Jordan field of operation (↑Tender Impulse, 2023; ↑UNRWA, 2024).

3.1. UNRWA's 2022 strategy on information and communication technologies (ICT) for education

UNWRA's strategy for ICT use in education includes one consideration for IWB use for teacher training with ICT support. It states,

> *"Teachers will also benefit from the greater availability of devices for students in school, as this will enhance opportunities for classroom activities such as project-based learning, or pair and group work. In addition, some classrooms will be provided with large digital displays (TV screens or interactive whiteboards), to allow for richer media to be integrated in classroom learning"* (↑UNRWA for Palestine Refugees in the Near East, 2022).

3.2. IWB use in Gaza

↑Salem & Salem (2016) investigated IWB use in Gaza, specifically the impact of teacher self-efficacy[5] and school management support for use of IWBs by high school teachers, using a modified Technology Acceptance Model (TAM).

TAM, developed by ↑Davis (1989) and grounded in the Theory of Reasoned Action, is a widely adopted framework used to understand why individuals accept or reject information technologies. Its primary goal is to predict how users' beliefs and attitudes shape their willingness to adopt a specific technology. The model centres on two main factors:

[5] ↑Salem & Salem (2016, p. 4) use ↑Wong et al.'s (2012) definition of teacher self-efficacy for IWB use: "the degree to which a teacher's judgement of his / her capabilities to teach with the aid of an IWB, and their personal beliefs in the use of IWBs as an effective teaching tool to increase students' performance in learning."

1. **Perceived usefulness:** The extent to which a user believes that using the technology will enhance their performance or productivity. In the case of IWBs, this includes teachers' beliefs that the tool will improve their teaching quality or enrich their lessons.
2. **Perceived ease of use:** The degree to which a user expects the technology to be user-friendly and require minimal effort. For IWB use, this reflects how easily teachers believe they can incorporate the technology into their classroom routines.

These perceptions influence users' attitudes towards using the technology, which in turn shape their intention to use it. A strong, positive intention typically leads to actual usage (↑Karthigesu & Mohamad, 2020; ↑Luo et al., 2023; ↑Salem & Salem, 2016; ↑Samsonova, 2017).

Using this model, ↑Salem & Salem (2016) surveyed 335 high-school teachers who used IWBs disseminated by Islamic Relief Palestine (IRPAL), which aimed to replace traditional whiteboards with IWBs in every school in Gaza and train teachers on their use. They found that supportive school management and teacher self-efficacy positively influenced perceived usefulness and ease of use of IWBs, which in turn supported behavioural intention to use IWBs and thus actual use of IWBs. To increase IWB adoption, ↑Salem & Salem (2016) recommend focusing on ensuring IWBs are used impactfully and with appropriate teacher training, rather than only making the technology itself easier to use. They encourage further research into other predictors of IWB use and retesting the TAM model with a broader and larger sample size of teachers.

In 2015, ↑Abdulmonim (2015) published a study on the use of IWBs among 282 UNRWA school tutors in Gaza. See Figure 2 below for more details.

Figure 2: *A case study on IWB application among UNRWA primary school teachers in the western region of the Gaza Strip, Palestine* (↑Abdulmonim, 2015)

Overview

This study, conducted by Dr Rania Abdulmonim in 2015, published in *Al-Aqsa University Journal*, explores the application of IWBs by teachers working in UNRWA schools located in the western region of the Gaza Strip. The study aimed to investigate the practical implementation of IWBs, explore teachers' perspectives on their significance, evaluate their proficiency in utilising these technological tools, and examine the impact of specialisation and years of experience, as well as the barriers that hinder their effective use.

Methodology

The study employed quantitative research, utilising a sample of 282 teachers from a population of 616 in UNRWA schools, covering Grades 1–9. Data collection was conducted through a specially crafted questionnaire related to IWB competencies, comprising 16 items that addressed the significance of IWBs and 24 items that focused on the challenges encountered in their use.

Key Findings

Usage and perceived value of IWBs

The study found that overall, IWB usage among UNRWA school teachers was low. Nevertheless, teachers demonstrated a strong awareness of the educational value of IWBs, viewing them as effective tools for delivering educational content in a more engaging and enjoyable manner. They also believed IWBs enhanced student involvement and participation, facilitated better information retention, contributed to improved classroom management, and supported teachers in lesson documentation and replay.

Barriers to effective IWB use

Numerous significant obstacles were identified impeding the effective use of IWBs; these included:

- **Technical challenges**: Teachers reported frequent and prolonged power outages, concerns regarding the safety of electrical wiring, and apprehensions about potential malfunctions.

- **Limitations in resources and infrastructure**: The absence of specialised IWB support personnel in schools, coupled with inadequate financial and technical resources to develop appropriate instructional materials, posed substantial challenges. With only one IWB available in each school's computer lab, teachers faced both time and access constraints regarding the IWBs.
- **Teacher preparedness and institutional support**: Teachers demonstrated limited proficiency in English related to IWB technologies. They also faced a lack of motivation and support from school administrations. Additionally, they had minimal opportunities to attend seminars, courses, or training workshops focused on IWB usage. Their demanding schedules further reduced the time available for learning and integrating IWBs into their teaching practices.

Statistical variations

The results revealed statistically significant differences in IWB usage levels based on the teachers' areas of specialisation. Teachers specialising in scientific subjects were more likely to use IWBs compared to those in literary fields or general education. On the other hand, no statistically significant differences were observed in IWB usage or skills based on the teachers' years of professional experience, a finding that aligns with similar studies.

Recommendations

The study provided several recommendations to enhance the integration and utilisation of IWBs in Gaza's educational system.

- Organise and maintain comprehensive and ongoing training programmes for teachers, focusing on the integration of IWBs into teaching practices.
- Promote the consistent adoption and application of IWBs within classrooms across all schools.
- Ensure that a sufficient number of IWBs are available to enable their broad and effective use across subjects.
- Introduce continuous professional development initiatives to help teachers refine and expand their competencies in using IWBs.

3.3. IWB use in the Dadaab refugee camp complex in Kenya

In Kenya's Dadaab refugee camp complex (↑Ostermann, 2015), 13 schools and vocational training centres (of which six are at primary level) have been connected to the internet with support from the United Nations High Commissioner for Refugees (UNHCR) and the Vodafone Foundation. Students at the solar-powered 'Instant Network Schools' have been provided with tablets, and teachers with IWBs to support their lesson delivery. While studies (↑Dahya & Dryden-Peterson, 2016; ↑Leomoi, 2025) on the experiences of teachers and learners using ICT at Dadaab refugee camp complex have been completed, they do not examine the use and impact of IWBs.

3.4. IWB use in Senegal

While not a refugee-specific application, the organisation CyberSmart Africa developed a proof-of-concept for solar-panelled IWBs and other ICT for low-cost classroom learning in Senegal in 2011, supported by USAID and Columbia University (↑CyberSmart Africa, no date; ↑Trucano, 2011). The organisation works specifically in schools with limited physical infrastructure and little to no electricity, conditions that they claim are representative of 80% of schools on the African continent and 20% of schools worldwide. CyberSmart Africa locally constructed these portable IWBs out of nylon sheets, PVC pipes, and a modified Nintendo Wii remote and powered them with batteries recharged using solar panels. While no studies on their impact on student learning outcomes since their initial implementation in 2011 appear to be available, ↑CyberSmart Africa's (2011) YouTube channel has posted several interviews with teachers and school leaders from the Fatick Region, as well as classroom observations of IWB use from 2011 to 2016.

> *"For student learning, the interactive whiteboard has a number of advantages compared to desktops. Because for the desktop, in reality, it's one student in front of his computer. With the interactive whiteboard, it's the opposite. It's the interactive whiteboard that comes into the classroom [...] and the students and teachers work together building knowledge. There is interactivity, groupwork, the development of initiative, student autonomy, and also students' creativity"* (Momadou Kane, Principal CEM de Mbellacadiao Middle School, 2011).

3.5. What does IWB usage and efficacy look like in Turkey?

Turkey is an upper-middle-income country with one of the largest IWB deployments globally, with over 626,000 IWBs in more than 740,000 classrooms (↑Bathanti & Abdul-Hamid, 2023). In 2010, Turkey launched the FATİH project (↑Bathanti & Abdul-Hamid, 2023). This project has five core pillars and is centred on the distribution and installation of digital technologies in classrooms, particularly interactive whiteboards (IWBs), and the distribution of tablets to all students up to the upper secondary level (↑Bathanti & Abdul-Hamid, 2023). The initiative aimed to equip 620,000 classrooms with IWBs and distribute tablets to all teachers and students, with a transition goal of a computer in every school to a computer in every classroom. In 2023, coverage exceeded 84% nationwide (↑Bathanti & Abdul-Hamid, 2023) and by 2025, over 626,441 IWBs had been installed in 742,829 classrooms. A third phase to add additional IWBs is underway.

3.5.1. Key findings of reviews of the FATİH project

A 2020 review, which combined both quantitative[6] and qualitative[7] research, found that the use of IWBs through the FATİH project had a positive impact on student achievement. The qualitative research also highlighted that IWBs helped increase student engagement through the use of visual and auditory stimulants, provided additional pathways for learning, increased student participation in the classroom, reduced time loss, and supported teachers in lesson planning and execution (↑Akar, 2020).

Another qualitative review of over 130 studies of the FATİH project in Turkey (↑Cengiz, 2020) highlighted the following:

[6] Forty-seven experimental studies investigating the effect of smart board use on academic achievement and meeting the inclusion criteria were accessed.

[7] This study included 20 prospective teachers studying in different programmes (Science and Technology, Turkish, Preschool, Social Studies, and Classroom Teaching) in Kilis, seven at Aralik University/Muallim Rifat Faculty of Education, and 14 teachers from different majors (Turkish, social studies, science and technology, mathematics, history, music, art, geography, and classroom teaching) working in schools affiliated to the Ministry of National Education.

- **Primary school teachers**[8] viewed the FATİH project as necessary and valuable, especially due to their need for visual tools in classrooms with young learners. However, they also anticipated challenges, citing a lack of preparation for using IWBs in their classrooms and a need for more in-service training to implement the project effectively (↑Çiftçi et al., 2013). Another review on user perceptions found that some teachers used IWBs the same way they would use a projector, which would limit student interaction (↑Milla et al., 2019).
- **Secondary school teachers and students**[9] had lower expectations and found limited benefit from the project. This was mainly due to the lack of subject-specific digital content and the functional limitations of the distributed tablets at the time of the study (↑Türel, 2012).

The review also highlighted **key challenges**, such as the need for:

1. **Increased technical support and training:** Teachers highlighted that while IWBs were a useful digital tool in their classrooms, they often faced roadblocks when a technical issue arose. Teachers reported problems using interactive whiteboards due to limitations in hardware, software, and the physical environment. These technical challenges hindered effective usage.
2. **Diverse digital content:** Some teachers emphasised the need for richer and more diverse digital content that was pedagogically aligned to the national curriculum.
3. **Additional professional development/training:** Teachers were not comfortable integrating IWBs into their pedagogical practices and expressed the need for in-service training focused on digital content and practical solutions to overcome usage difficulties.

IWBs, in general, can have high installation and maintenance costs. However, given that the Turkish government and various donors have been investing in IWBs since 2012, there is an opportunity to get the most value from the hardware that has already been installed. For example, the

[8] This study was carried out with 80 classroom teachers during the 2011–2012 academic year.

[9] In this study, 140 primary school teachers were surveyed using an open-ended questionnaire that focused on potential IWB usage challenges.

significant number of IWBs installed in schools nationwide offers a potentially cost-effective way to scale teacher training and content delivery.

Overall, numerous small-scale studies and evaluations of the use of IWBs as part of the FATİH project were conducted between 2012 and 2017; however, such assessments appear to have declined in frequency thereafter. Since 2020, there has been a noticeable shift towards literature reviews and secondary research, with limited evidence of recent large-scale or primary evaluations of the project. There also seems to be a gap in large-scale national assessments on the use of IWBs to support learning outcomes in Turkey. However, since this scan focuses on resources that are published in English, a review of Turkish language studies could yield more results.

4. Efficacy[10] of IWBs

4.1. Teacher engagement and uptake

As noted in previous sections, teachers typically have positive attitudes and motivation regarding IWBs as instructional tools to boost student engagement and increase lesson efficiency. In this section, we draw from a multitude of studies of EFL, English as a second language (ESL), English, mathematics, science, as well as special education teachers for students in Grades 1–8 in Australia, China, Greece, Indonesia, Jordan, Saudi Arabia, Turkey, and the UK. The studies reference employed methodologies that included experimental design, cross-sectional questionnaires, baseline and endline surveys, quantitative descriptive methods, key informant interviews, focus group discussions, classroom observations, screening methodologies, secondary data analysis of lesson plans and learning materials, and thematic content analysis across several qualitative studies of the FATİH project.

There is a dearth of longitudinal studies in this area (save for the four-year UK ICT Testbed project highlighted by ↑Hennessy & London (2013), with most referenced studies ranging from several weeks to one academic year. Thus, it is challenging to draw long-term conclusions on teacher engagement with and uptake of IWBs over time.

4.1.1. Multimodal features for multisensory teaching

EFL and mathematics teachers in Jordan and Turkey reported that the multimodal features of IWBs enhance access to education by enabling multisensory teaching. Using visual aids, animations, videos, images, sounds and movement, teachers can make abstract and complex ideas more concrete and accessible in an engaging manner. Teachers note improved comprehension, cognition, retention and recall in their students when they use IWBs to review and summarise educational content (↑Abuhmaid, 2014; ↑Alhumsi, 2024; ↑Erdener, 2021; ↑Kirbaş, 2018). Special education teachers based in Greece (↑Drigas & Papanastasiou, 2014) note that the multisensory teaching aspect is particularly beneficial for students with diverse learning needs; this is further illustrated in Section 4.4.4.

[10] 'Efficacy of IWBs' here refers to teacher engagement with and uptake of IWBs, student motivation and engagement with IWBs, and students' positive learning outcomes.

4.1.2. Efficiency and flexibility

IWBs can also support teachers to teach more efficiently and have greater flexibility in their teaching strategies. Teachers can display physical materials using visualisers, access online content, and easily save and reuse lesson materials. Additionally, IWBs offer flexibility for different teaching styles and activities, which can meet students' diverse needs and help maintain classroom focus by keeping students engaged (↑Hennessy & London, 2013; ↑Moss et al., 2007).

By helping to save time, streamline lesson preparation, and provide quick access to digital resources, IWBs can significantly aid teachers in disseminating their lessons—when used appropriately and with sufficient training (↑Hennessy & London, 2013; ↑Masnun et al., 2025; ↑Tunaboylu & Demir, 2016).

4.1.3. Classroom management

The impact of IWB use on classroom management can vary. By boosting student engagement through visually stimulating lessons and encouraging greater interaction and dialogue, the use of IWBs can increase students' focus and lead to fewer behavioural disruptions (↑Alghamdi, 2018; ↑Cengiz, 2020; ↑Masnun et al., 2025).

When IWBs are used in conjunction with tablets, mice, or clickers, teachers can move around the classroom freely while operating the IWB. This can allow for greater eye contact with and monitoring of student behaviour and engagement while promoting widespread participation from students around the classroom (↑Hennessy & London, 2013; ↑Kirbaş, 2018; ↑Moss et al., 2007).

However, how IWBs are used can impact their effectiveness in supporting classroom management. IWBs can reinforce a traditional, transmission-style teaching approach when used only as display tools or incorporated into existing teaching methods, thereby limiting the use of their interactive and collaborative features (↑Alghamdi, 2018; ↑Hennessy & London, 2013).

Perceived non-usefulness among teachers can also persist, with ESL teachers in China reporting that IWBs were distracting, limited in-depth thinking, proved to be time-consuming and effort-demanding, led to superficial interactions, and could only support a limited number of students at a time (↑Luo et al., 2023).

4.2. Effective pedagogical strategies and best practices for IWB use

To fully leverage the capabilities of IWBs in educational settings, the most impactful pedagogical methods and recommended practices should involve a thorough and integrated approach (↑Alghamdi, 2018; ↑Dhindsa & Shahrizal-Emran, 2011; ↑Drigas & Papanastasiou, 2014; ↑Hennessy & London, 2013; ↑Kuo et al., 2015; ↑Masnun et al., 2025; ↑Tombak & Ateskan, 2019; ↑Tunaboylu & Demir, 2016). An integrated approach extends beyond mere content projection and aims to support learning that is active, multimodal, and collaborative in nature. This comprehensive method entails purposeful use of interactive functions and is reinforced through essential professional development and infrastructural support. For recommendations about efficient techniques for digitising instructional materials and deliberate content planning, see Section 4.5.

Below are several key components of an integrated pedagogical approach. In addition, we share key guidelines for effective teacher training on IWBs.

4.2.1. Interactive marking and on-the-spot annotation

Instructional content can be designed to support real-time interaction, allowing both educators and students to draw, highlight, write on, and colour-code displayed materials directly (↑Abdulmonim, 2015; ↑Alghamdi, 2018; ↑Ishtaiwa & Shana, 2011; ↑Kılıç et al., 2015; ↑Luo et al., 2023). This facilitates immediate feedback, encourages student participation, and allows for error correction as the lesson progresses. Additionally, IWBs enable automatic feedback for language scripts such as Arabic, detecting errors and displaying correct character formation (↑Masnun et al., 2025).

4.2.2. Hands-on interactive learning tasks

Features such as drag-and-drop exercises, hide-and-reveal functionality, matching tasks, and animated object movement can be embedded within lessons to facilitate more hands-on learning (↑Alghamdi, 2018; ↑Hedberg & Freebody, 2007; ↑Moss et al., 2007). These features can promote active student involvement, making lessons more interactive and often more enjoyable, especially for younger learners (↑Masnun et al., 2025; ↑Tombak & Ateskan, 2019; ↑Saltan, 2019). Interactive features are particularly effective for educational games and formative assessments that require student input. These activities can increase student engagement and provide instant feedback (↑Drigas & Papanastasiou, 2014; ↑Masnun et al., 2025; ↑Tunaboylu & Demir, 2016).

4.2.3. Enhanced visualisation of abstract concepts

IWBs offer substantial support for the visual representation of complex or abstract topics, which can help students understand difficult concepts (↑Drigas & Papanastasiou, 2014; ↑Hedberg & Freebody, 2007; ↑Hennessy & London, 2013; ↑Tunaboylu & Demir, 2016). Tools that enable the manipulation of text, as well as multimedia elements such as videos and graphics, can contribute to clearer and more transparent instruction (↑Gillen et al., 2007; ↑Ishtaiwa & Shana, 2011; ↑Moss et al., 2007; ↑Tunaboylu & Demir, 2016). The ability to zoom in and out of content and move elements around on the screen can enhance understanding by providing greater interaction with learning concepts (↑Hennessy & London, 2013; ↑Luo et al., 2023; ↑Samsonova, 2018; ↑Tunaboylu & Demir, 2016).

4.2.4. Instant access to online educational resources

Through their internet connectivity, IWBs can enable teachers to seamlessly incorporate online tools, articles, maps, and simulations into their lessons (↑Alghamdi, 2018; ↑Hedberg & Freebody, 2007; ↑O'Donnell, 2015). By offering learning beyond existing printed materials, browsing and displaying live web content can support spontaneous learning opportunities and advanced searches, allowing lessons to remain current and responsive to students' interests (↑Olaimat et al., 2022).

4.2.5. Facilitating discussion and collaborative learning

Teachers can use IWBs to create a shared visual workspace, where learners can compare ideas, collaborate on tasks, and build understanding collectively (↑Abuhmaid, 2014; ↑Drigas & Papanastasiou, 2014; ↑Ishtaiwa & Shana, 2011; ↑Kuo et al., 2015; Shana, 2011; ↑Tombak & Ateskan, 2019). The IWB can become a platform for making student thinking visible, encouraging dialogue and joint analysis through visual comparisons and collective annotation, and sharing feedback (↑Drigas & Papanastasiou, 2014; ↑Hedberg & Freebody, 2007; ↑Moss et al., 2007).

4.2.6. Lesson storage and material reuse

Teaching sessions created using IWBs can be saved, exported, archived, reused, and printed in their entirety, including annotations and student contributions (↑Alghamdi, 2018; ↑Ishtaiwa & Shana, 2011; ↑Moss et al., 2007; ↑Samsonova, 2018; ↑Tunaboylu & Demir, 2016). These saved lessons can be reused in future classes and reviewed by students who missed class or need additional reinforcement (↑Hedberg & Freebody, 2007; ↑O'Donnell, 2015; ↑Samsonova, 2018).

4.2.7. Meeting diverse learning needs

Teachers should use IWBs to accommodate a wide variety of learning styles, including visual, auditory, and kinesthetic/tactile learners (↑Hedberg & Freebody, 2007; ↑Ishtaiwa & Shana, 2011; ↑Tunaboylu & Demir, 2016). The multimodal functionality of IWBs is beneficial for students with special educational needs, helping to maintain their attention and enhance comprehension through the use of varied sensory inputs and interactive design (↑Drigas & Papanastasiou, 2014; ↑Hedberg & Freebody, 2007; ↑Ishtaiwa & Shana, 2011; ↑Kirbaş, 2018; ↑Samsonova, 2017; ↑Samsonova, 2018). For more information on the types of multimodal content that can cater to the needs of diverse learners, see Section 4.5.

By deliberately applying the strategies listed above and ensuring the necessary support structures are in place, educators can move far beyond the passive use of technology. They can transform their teaching practices through the interactive, multimodal, and participatory learning experiences that IWBs make possible (↑Alghamdi, 2018; ↑Drigas & Papanastasiou, 2014; ↑Luo et al., 2023; ↑Masnun et al., 2025; ↑Tombak & Ateskan, 2019; ↑Tunaboylu & Demir, 2016). Through thoughtful planning, technological integration, and pedagogical innovation, IWBs can open the door to instructional methods that would be difficult or impossible to achieve through traditional approaches alone (↑Erdener, 2021).

4.3. Recommendations for effective teacher training on IWB use

To fully harness the potential of IWBs in teaching and learning environments, thorough and effective teacher training is essential (↑Alghamdi, 2018; ↑Hennessy & London, 2013; ↑Ishtaiwa & Shana, 2011; ↑Luo et al., 2023; ↑Masnun et al., 2025; ↑Shams & Dabaghi, 2014). This training must extend beyond basic technical tutorials and aim to integrate the technology into meaningful, pedagogically sound classroom practices for long-term and impactful use.

4.3.1. Focus on pedagogy rather than just technical skills

Training should move beyond simply teaching how to operate IWB tools or navigate software. A common issue with past training efforts has been an overemphasis on technical skills without demonstrating how IWBs can enhance subject-specific teaching in areas such as literacy, numeracy, and content instruction (↑Alghamdi, 2018; ↑Hennessy & London, 2013; ↑Moss et al., 2007; ↑Türel & Demirli, 2010). Effective training should align IWB use with

pedagogical goals, helping teachers visualise abstract ideas through images, videos, mind maps, and animations (↑Hennessy & London, 2013; ↑Luo et al., 2023; ↑Masnun et al., 2025). It should also support interactive whole-class teaching, enabling tasks such as real-time writing, drag-and-drop, matching, and hide-and-reveal activities that encourage student participation (↑Moss et al., 2007).

4.3.2. Offer ongoing, varied, and adaptive professional development

IWB training should be sustained over time rather than being a one-off session, as proficiency requires consistent practice (↑Alghamdi, 2018; ↑Moss et al., 2007; ↑Samsonova, 2021). Training must also account for teachers' diverse skill levels; beginners require foundational technical instruction, while more experienced users should be guided toward advanced pedagogical applications (↑Alghamdi, 2018; ↑Moss et al., 2007; ↑O'Donnell, 2015; ↑Samsonova, 2017). A range of formats should be offered, including workshops, on-site coaching, peer-to-peer mentoring, classroom observations, and self-directed learning (Alghamdi, 2018; ↑Samsonova, 2021). Teachers should be provided with opportunities to observe effective IWB use in real lessons and learn through hands-on trial and error (↑Alghamdi, 2018; ↑Moss et al., 2007).

4.3.3. Prioritise practical, hands-on experience

Training should be practice-oriented rather than theoretical (↑Alghamdi, 2018). Teachers should be offered active opportunities to explore IWB tools in realistic teaching contexts. By encouraging experimentation, teachers can build up their confidence and familiarity, making it easier for them to apply what they've learnt to their own live instruction (↑O'Donnell, 2015; ↑Moss et al., 2007).

4.3.4. Leverage expert educators as peer mentors

Schools should identify experienced IWB users who can serve as digital champions to act as informal mentors (↑Abuhmaid, 2014; ↑Alghamdi, 2018; ↑Hennessy & London, 2013; ↑Moss et al., 2007). These mentors should have strong pedagogical and technical expertise and be available for daily, subject-specific support within departments or teaching teams (↑Abuhmaid, 2014).

4.3.5. Incorporate video demonstrations for learning

Several studies (Hennessy & London, 2013; ↑Hennessy et al., 2022; ↑Mercer et al., 2010) have evaluated or incorporated IWB training videos into their study designs. These researchers' findings demonstrate that video can serve as a powerful tool for professional development. Watching actual classroom footage can help teachers understand effective IWB use, especially for difficult topics, and spark discussion and reflection. Teachers can also benefit from recording and reviewing their own lessons to evaluate and improve their practices.

4.3.6. Ensure technical support and equipment access

Reliable technical support is essential for teachers to address software, hardware, or classroom layout issues (↑Alghamdi, 2018; ↑Ishtaiwa & Shana, 2011; ↑Samsonova, 2021). If possible, and pending resource availability, IWBs should be permanently installed in every classroom, and not confined to shared ICT rooms with limited use for each teacher (↑Abuhmaid, 2014). Daily access can increase teacher confidence and encourage frequent use (↑Hedberg & Freebody, 2007; ↑Samsonova, 2021).

4.3.7. Acknowledge the time teachers need to invest in lesson planning and development

Developing IWB-integrated lessons, especially those that are interactive and differentiated, requires significant planning time (↑Abuhmaid, 2014; ↑Ishtaiwa & Shana, 2011; ↑Samsonova, 2017; ↑Samsonova, 2018; ↑Tombak & Ateskan, 2019). If possible, schools should offer ready-made, subject-specific templates and digital resources. Shared online repositories can help teachers save time and collaborate more effectively (↑Samsonova, 2017; ↑Samsonova, 2018; ↑Samsonova, 2021). Institutions could also consider adjusting workloads or schedules to allow dedicated planning and training time for teachers (↑Alghamdi, 2018).

4.3.8. Build confidence and ownership

IWB training should aim to build teacher confidence, as this directly impacts their use of IWBs in their classrooms (↑Alghamdi, 2018; ↑Tombak & Ateskan, 2019). Professional learning should be collaborative and not imposed, allowing teachers to tailor their IWB training to their individual experiences, needs, and teaching styles (↑Moss et al., 2007). The focus should always be on improving teaching quality and student outcomes, rather than just showcasing flashy features or for convenience (↑Abuhmaid, 2014; ↑Ishtaiwa & Shana, 2011).

By following these in-depth training recommendations, educational institutions can support a more meaningful and sustainable integration of IWBs into everyday instruction. This approach can increase teacher competence and confidence and enable truly interactive, multimodal, and student-centred learning experiences that are made possible through the thoughtful use of this technology (↑Alghamdi, 2018; ↑Ishtaiwa & Shana, 2011; ↑Luo et al., 2023; ↑Moss et al., 2007; ↑Shams & Dabaghi, 2014; ↑Tombak & Ateskan, 2019; ↑Tunaboylu & Demir, 2016).

4.4. Student engagement, learning outcomes, and IWB uptake

There is clear evidence to suggest that the use of IWBs has a noticeable impact on students' engagement, motivation, participation, and uptake across various educational contexts, when implementation and teacher training are of high quality. In this subsection, we draw from a multitude of studies on EFL and English, mathematics, and science students in Grades 1–8 in Germany, Iran, Saudi Arabia, Taiwan, Turkey, the UK, and the US. Relevant learnings from a study of high school students in Turkey (↑Tombak & Ateskan, 2019) are also noted. The studies reference employed methodologies, including experimental design, cross-sectional qualitative and quantitative questionnaires, key informant interviews, focus group discussions, classroom observations, and secondary data analysis of lesson plans and learning materials.

There is a dearth of longitudinal studies in this area as well, with most referenced studies ranging from several weeks to one academic year. However, findings from the four-year UK ICT Testbed project highlighted by ↑Hennessy & London (2013) and a two-year study of primary school students in UK literacy and numeracy lessons conducted by ↑Higgins et al. (2007) are included. For further findings on learning outcomes resulting from student engagement and the uptake of IWBs, see Section 4.4.5.

4.4.1. Engagement and motivation

Many students have reported feeling more involved and motivated in classroom lessons when IWBs are used. The multisensory features, visual and auditory appeal, and opportunities for more varied participation can help maintain students' focus (↑Higgins et al., 2007; ↑Shams & Dabaghi, 2014; ↑Torff & Tirotta, 2010). Immediate feedback can support low-stress learning, while alignment with students' digital lifestyles can make lessons feel modern and relevant. Students also believe IWBs improve their

understanding and retention of material (↑Tombak & Ateskan, 2019; ↑Torff & Tirotta, 2010; ↑Tunaboylu & Demir, 2016).

Students often described lessons using IWBs as more fun and exciting, especially when interactive elements such as games, quizzes, and hands-on activities were integrated into the learning process (↑Alghamdi, 2018; ↑Shams & Dabaghi, 2014; ↑Torff & Tirotta, 2010).

At the same time, not all research supports a strong motivational impact with the use of IWBs, with some findings suggesting only slight and weak improvements in self-reported motivation(↑Alghamdi, 2018; ↑Luo et al., 2023). Some studies found that once the initial novelty of IWB use faded for students, teachers needed to design activities that fully utilised IWBs' ability for engagement and manipulation to sustain meaningful engagement over time (↑Luo et al., 2023; ↑Tunaboylu & Demir, 2016).

4.4.2. Uptake and participation

The use of IWBs encourages greater student participation, with learners more actively asking questions and volunteering to problem-solve at the board, demonstrating a shift from passive to active involvement, compared to traditional classroom settings. Students enjoy the tactile interaction with the IWB, as they can drag and drop items, write or draw answers, and manipulate visual content (↑Alghamdi, 2018; ↑Kirbaş, 2018). However, researchers also found that teachers sometimes dominate the use of the IWB during lessons, reducing students' opportunities to engage with the technology directly (↑Kuo et al., 2015).

4.4.3. Enhancing active and collaborative learning

IWBs can promote hands-on interaction, which students enjoy and find engaging, especially those who are typically less active in the classroom. Likewise, the use of IWBs can also support collaborative learning by encouraging group work and discussion (↑Masnun et al., 2025; ↑Moss et al., 2007). They can foster a more student-centred approach, where learners take a more active role in their learning and engage directly with concepts (↑Kühl & Wohninsland, 2022; ↑Masnun et al., 2025; ↑Tombak & Ateskan, 2019; ↑Wong, 2009).

4.4.4. Learners with special educational needs and disabilities

↑Le Lant & Lawson (2015) highlight that content displayed on IWBs can be dynamic, offering substantial advantages for presenting curriculum

content in ways that engage students with special educational needs and disabilities. However, the same study shows that lessons conducted without IWBs resulted in higher levels of relevant verbal engagement. Students produced up to twice as much language and vocal engagement in non-IWB lessons, which is significant, as such language production helps build knowledge networks and deepens understanding.

A review of studies from 2000 to 2013 highlights that using IWBs can help to keep learners with SEND engaged in classroom facilities by scaffolding their learning through technical and pedagogical interactivity. The study highlights that IWBs are sometimes seen to be helpful for learners with severe, complex, and/or moderate learning disabilities; autistic spectrum disorder (ASD); attention deficit hyperactivity disorder; and learners with hearing or visual impairments or physical disability (↑Drigas & Papanastasiou, 2014).

For example, for learners with visual impairments, IWBs can be used to magnify content presented on the screen, change backgrounds or text colours, record instructions for lessons, and print class notes on a Braille translator (↑Drigas & Papanastasiou, 2014). Researchers observed that the integrated use of IWBs by teachers helped learners with ASD develop the ability to imitate sounds, words, and actions, and also helped increase focus and reduce distractions (↑Drigas & Papanastasiou, 2014). However, while there are some benefits to using IWBs to support learners with SEND, researchers emphasise the importance of providing teachers with additional training and tools to assist learners and improve learning outcomes (↑Ishtaiwa & Shana, 2011).

4.4.5. Learning outcomes: benefits

Much like all other EdTech devices, the mere use of IWBs alone does not lead to improved student learning outcomes. Adoption of this hardware must be accompanied by strong teacher professional development, contextualised, and linked to robust digital literacy and content (↑Hennessy & London, 2013). As ↑Hennessy & London (2013) highlight, the results from the 2002–2006 UK ICT Testbed project (a large-scale ICT investment project which included IWBs) show that while the impact of IWBs on students is mediated by their use by teachers, there is a positive effect on learner achievement which can be attributed to IWBs.
The review also highlights the following findings:

- **Teacher-dependent impact:** The use of IWBs does not inherently transform pedagogy; their effectiveness depends on teachers' beliefs, goals, prior experiences, and willingness to adapt. Sustainable

pedagogical change requires long-term, well-supported professional development.

- **Context matters:** The impact of using IWBs on student learning is highly variable and context-specific. Positive effects are not universal, but are more likely when IWBs are integrated meaningfully into pedagogy and used in conjunction with other technologies.
- **Time and training yield results:** Significant student achievement gains, especially for average to high-achievers, tend to appear only after at least two years of IWB use, likely due to the time teachers need to become proficient and embed IWBs effectively into instruction.

In addition, a review of the use of IWBs in the UK by ↑Condie (2007) highlights that IWBs can also be effective in improving both learner motivation and outcomes when coupled with other features and tools, such as animations, simulations, and display and presentational software. Research from other countries confirms that teacher responses to IWBs vary significantly in practice, and no one-size-fits-all conclusions can be drawn. In a three-year longitudinal study, ↑Cutrim Schmid & Whyte (2012) investigated how non-native English language teachers in secondary and vocational schools in France and Germany integrated IWBs into their classrooms. Teachers who integrated IWBs into their everyday teaching practices were influenced by various factors, including individual teaching experience, pedagogical beliefs, institutional expectations, and how well the technology aligned with their curricular and personal goals. The authors highlighted that with appropriate training, sustained feedback, and time to adapt, teachers can successfully integrate the use of IWBs into their teaching. The research also underscores that lasting pedagogical change cannot be mandated from the top down, especially when training is delivered in isolation and without continuous, in-classroom support.

An evaluation of Project Sankoré,[11] a Senegalese programme that equipped selected classrooms with an interactive whiteboard connected to a computer and a projector, and supported learners in Grades 1 and 2, had mixed results. Qualitative research as part of this evaluation highlighted significant challenges during the implementation of the programme,

[11] About 370 interactive whiteboards were distributed to schools that met safety, accessibility, and electricity requirements for use in Grades 1 and 2. The teachers involved in the implementation of the project were trained as technicians to support installing and repairing equipment when required. The kits were distributed to the schools during the middle of 2014 and teaching with the whiteboards began in January/February 2015.

including a lack of long-term and continuous training of teachers and technicians to maintain and repair hardware (↑Lehrer et al., 2019). The study also recommended that if the pilot were to expand, it should only be done within urban areas, unless significant changes were made to the training design and additional infrastructure investments were made. These findings underscore the importance of evaluating the digital landscape before investing in large-scale hardware to prevent exacerbating the digital divide.

Although much of the qualitative research of the Sankoré programme highlights key implementation challenges such as insufficient training for teachers and technicians and mechanical issues with the IWBs, quantitative research suggests, on average, large positive impacts of the programme on student learning, primarily for mathematics in urban schools (↑Lehrer et al., 2019).

In the MENA region, a review of the use of IWBs in Iran explored how different types of multimedia annotations delivered through IWBs, such as audio, images, and video, impacted Iranian learners' English reading comprehension. Results showed that video annotations were more effective for vocabulary recognition than text or audio annotations and could positively impact reading comprehension for learners (↑Shams & Dabaghi, 2014). Similarly, a study in Kuwait that investigated the effectiveness of IWBs on students' Arabic listening skills at Kuwaiti universities found that multimodal input (audio, visuals, and interactive features) appears to be especially beneficial for understanding spoken Arabic (↑Aldhafiri, 2020). Although the Kuwait example refers to a tertiary institution (and this scan primarily focuses on primary and secondary grades), the lessons from this study highlight the potential for IWBs to support the improvement of student learning outcomes.

While the studies by ↑Shams & Dabaghi (2014) and ↑Aldhafiri (2020) highlight a positive relationship between the use of IWBs and student comprehension and learning outcomes, they both stress that effective multimodal approaches require rigorous and continuous teacher training. However, ↑Hennessy & London (2013) highlight that one of the key issues found during teacher training for the use of IWBs is that it often focuses more on the use of the IWB technology than on teaching and improving literacy or numeracy skills. In many examples, the typical introduction teachers receive is a brief session provided by the IWB manufacturer or the programme implementer, which tends to concentrate solely on the technical functions of the device. However, research shows that this kind of training is far from sufficient. Without deeper, pedagogically driven

support, teachers often struggle to use IWBs in ways that truly enhance teaching and learning (↑Hennessy & London, 2013).

4.5. Effective methods to digitise and develop learning materials for IWB use

In Turkey, alongside the FATİH project, the Eğitim Bilişim Ağı (EBA), or Education Information Network, has been supporting IWB use by distributing extensive content designed for lessons taught with IWBs and curated by MoNE (↑Bathanti & Abdul-Hamid, 2023; ↑Kirbaş, 2018). Reviews focusing on FATİH's implementation (↑Bathanti & Abdul-Hamid, 2023) note the importance of converting teaching and learning materials into digital formats to increase accessibility, inclusivity, and reach in order to reduce educational disparities. For IWB use to support these efforts effectively, it is critical to be deliberate and intentional when developing and incorporating content for IWBs. Below are several best practices for converting traditional teaching materials into IWB-compatible digital formats. We highlight the most effective types of digital learning content that optimise the interactive and multimodal capabilities of IWBs to support diverse learning and sensory modalities, encourage student participation, and implement learner-focused approaches (↑Hennessy & London, 2013; ↑Masnun et al., 2025).

4.5.1. Techniques for digitising traditional education materials

Digitising pre-existing content for use on IWBs involves turning physical teaching resources into digital formats that are suitable for interactive classroom use. In their paper on interactivity in learning materials, ↑Ildikó & Szabo (2018) discuss the following techniques for converting materials.

- **Written texts**: Printed or handwritten materials can be digitised by either transcribing them into editable text files or by scanning physical copies into digital form.
- **Images and graphics**: For physical, paper-based visuals, scanning is the standard approach. Digital photographs are typically ready for direct use, and image editing and display software can be used to supplement any necessary changes. When incorporating high-resolution images or multimedia content, it is essential to consider file sizes to prevent slowing down the IWB system due to heavy processing demands and ensure smooth performance.

4.5.2. Strategic content development and design for digitisation

Effective IWB use requires thoughtful preparation that addresses both technological functionality and pedagogical intent (↑Masnun et al., 2025). Prior to digitising existing teaching materials, it is essential to plan how content will be displayed and structured on the IWB screen to optimise learning (↑Ildikó & Szabo, 2018). This includes defining the educational purpose, identifying the target learners, and considering the desired learning outcomes for the interactive curriculum (↑Ildikó & Szabo, 2018). Aesthetic design considerations, such as font size, colour scheme, and graphic layout, should be carefully selected to ensure clear visibility, as well as the intended emotional and cognitive effects (↑Ildikó & Szabo, 2018).

Depending on lesson objectives, instructional designers and teachers should strategically select illustrations and photos, graphs and charts, and data visualisations (↑Masnun et al., 2025; ↑Ildikó & Szabo, 2018). They should consider how they would like to visualise information and structure content for a large IWB screen to maximise clarity, impact, readability, and visual flow (↑Ildikó & Szabo, 2018). Materials should also be designed so that content is broken up and can be introduced incrementally to support learners' comprehension and the building of knowledge over time (↑Masnun et al., 2025; ↑Tunaboylu & Demir, 2016). While IWBs can accelerate lesson delivery by integrating pre-prepared resources, teachers should balance this with opportunities for slower and even live content creation, which allows students to follow and process information more easily (↑Moss et al., 2007; ↑Tunaboylu & Demir, 2016).

It is critically important to ensure interactive content aligns with curriculum and student needs, directly supports lesson goals, and adheres to educational standards. Content should be customised for diverse learners, and tailored activities should match individual students' interests and developmental levels (↑Alghamdi, 2018; ↑Masnun et al., 2025; ↑Samsonova, 2018; ↑Tsayang et al., 2020; ↑Tunaboylu & Demir, 2016).

4.5.3. Comprehensive multimedia integration

As mentioned previously, IWBs are a highly effective tool for presenting a wide range of multimedia elements, which can significantly boost learner engagement, comprehension, and memory retention (↑Hennessy & London, 2013). Visual content, including images, photos, and graphics, can break down complex, abstract, or unfamiliar concepts. Teachers can adjust

image size, zoom in on specific details, and annotate them directly to emphasise important aspects (↑Hennessy & London, 2013; ↑Luo et al., 2023; ↑Wong, 2009). IWBs can also be used to animate and move static images, supporting students' conceptual development (↑Hennessy & London, 2013; ↑Samsonova, 2017).

Video clips and animated content can transform theoretical information, such as scientific phenomena and mathematical operations, into more vivid, dynamic, and comprehensible material, and can be valuable in language classes to demonstrate vocabulary and pronunciation (↑Moss et al., 2007; ↑Samsonova, 2017; ↑Tunaboylu & Demir, 2016). Audio files such as music, narration, and sound effects can support pronunciation practice, musical exploration, and listening comprehension; they can be particularly helpful for learners with auditory processing preferences or attention challenges, as they engage additional senses (↑Abdulmonim, 2015; ↑Hennessy & London, 2013; ↑Ishtaiwa & Shana, 2011).

IWBs can also be used to display and interact with a variety of digital file formats, including PowerPoint presentations, Word documents, and PDF files, which can help organise and pace instructional content (↑Cengiz, 2020; ↑Moss et al., 2007; ↑Samsonova, 2018; ↑Tunaboylu & Demir, 2016). eBooks and digital textbooks can promote interactivity that standard textbooks or printed instructional materials cannot accomplish as well (↑Cengiz, 2020). Teachers can enhance these files by layering multimedia and integrating interactive elements, such as hyperlinks, diagrams, and graphs, to organise lessons in more structured and engaging ways (↑Hedberg & Freebody, 2007; ↑Moss et al., 2007). Incorporating educational games, quizzes, and formative assessment tools within content design itself can help maintain engagement and assess student understanding in a dynamic and enjoyable way (↑Karthigesu & Mohamad, 2020; ↑Kühl & Wohninsland, 2022; ↑Kuo et al., 2015; ↑Luo et al., 2023; ↑Tsayang et al., 2020).

4.5.4. Boosting efficiency and reusability

As mentioned previously, one of the major advantages of IWBs is the ability to save interactive sessions, including annotations and student contributions (↑Alghamdi, 2018; ↑Ishtaiwa & Shana, 2011; ↑Moss et al., 2007; ↑Samsonova, 2018; ↑Tunaboylu & Demir, 2016). This can enable lesson reuse and sharing with colleagues, reducing teacher workload and potential duplication of efforts when designing and developing lessons for IWB use (↑Hedberg & Freebody, 2007; ↑O'Donnell, 2015; ↑Samsonova, 2018).

Teachers can streamline lesson development by using existing IWB templates or creating reusable ones (↑Hedberg & Freebody, 2007). Resource banks, either self-made or collaboratively developed, can significantly reduce planning time and support lesson continuity (↑Hennessy & London, 2013). Collaboration among teachers for lesson development is highly beneficial, allowing for the sharing of lessons via educational websites (e.g., SMART Exchange,[12] Teachers Pay Teachers[13]) or school networks (↑Hedberg & Freebody, 2007; ↑Hennessy & London, 2013; ↑Samsonova, 2017; ↑Samsonova, 2018). A dedicated school-wide or departmental resource repository can enhance collaboration and standardise instructional quality (↑Ishtaiwa & Shana, 2011; ↑Samsonova, 2017; ↑Samsonova, 2018).

While IWBs offer extensive opportunities for enhancing content delivery and lesson digitisation, their true educational value depends on how skillfully teachers integrate the technology into their pedagogical practice, as highlighted in Section 4.2 (↑Alghamdi, 2018; ↑Hedberg & Freebody, 2007; ↑Masnun et al., 2025; ↑Salem & Salem, 2016). The key lies not in the novelty of the device but in the thoughtful design and purposeful use of content that leverages IWB features to deepen learning, clarify complex ideas, and stimulate active engagement (↑Alghamdi, 2018).

[12] See https://suite.smarttech-prod.com/lumio-library. Retrieved on 20 August 2025.

[13] See https://www.teacherspayteachers.com/. Retrieved on 20 August 2025.

5. Considerations for IWB use for refugee learning

This section outlines key considerations for the use of IWBs for refugee learning. The evidence and key takeaways outlined in previous sections highlight the potential for IWBs to support refugee learning, especially language acquisition. In addition, the section highlights ways in which teachers can use IWBs to enhance their teaching practices, especially in multicultural classrooms.

5.1. Training teachers, learners, and school leaders on the use of IWBs is imperative to build student and teacher efficacy

Investment in technology, such as IWBs, should not be a one-off undertaking that focuses solely on the provision and use of hardware. Instead, continuous investment is required in teacher training and knowledge sharing, as well as technical support and repair, and infrastructure development. In addition, teacher training cannot solely focus on the operation of the hardware. If the desired outcome is to improve student learning outcomes, teacher training must include support on how to integrate subject learning with technology effectively. For learners, initial high levels of engagement may reduce, requiring teachers to keep lessons interactive and varied. The impact of IWBs heavily depends on how teachers use them; if use is limited to functioning as a projector or a tool that only the teacher engages with (e.g., placing an IWB at the front of the class and rarely calling up students to interact with the tool), student engagement can drop.

This rapid scan highlights evidence of cases where student learning outcomes (including for refugee learners) were seen to improve, as teachers were not only trained on the hardware, but also taught how to improve literacy and numeracy skills by using IWBs as an additional pedagogical tool. In addition, building teacher confidence through mentorship, collaboration, and strong school leadership is essential for successful implementation (↑Cengiz, 2020; ↑Hennessy & London, 2013; ↑O'Donnell, 2015). Strong leadership and a supportive school environment, including technical support and encouragement, are essential for successful IWB use. Without this backing, IWBs are often underused or abandoned (↑Abuhmaid, 2014; ↑Hedberg & Freebody, 2007).

5.2. Use of IWBs to support language instruction can be a valuable tool for refugee learners

For learners who are integrating into a new schooling system and learning a new language, using IWBs to promote English or Arabic instruction in refugee contexts was seen to be moderately effective. Using IWBs to promote multimodal instruction and learning can be a pathway to consider when supporting refugee learners with English and Arabic language skills (↑Masnun et al., 2025; ↑Olaimat et al., 2022).

5.3. Ownership of the product and its use require careful planning

Several practical challenges, including hardware and software malfunctions, as well as connectivity issues, can be associated with the use of IWBs. In addition, hardware access without a clear ownership structure and contingency plans will impact overall motivation and use of tech hardware (IWBs in this case). A strong implementation plan that outlines ownership structures and how handovers will take place over time needs to be defined when planning to use and introduce new hardware. While the use of IWBs should be part of teacher and school leader training, it is also important to have support staff who are available to assist teaching staff with troubleshooting or addressing breakage.

In some low-capacity contexts, another possible strategy for dealing with technical issues is the introduction of a technical phone hotline staffed by trained individuals who can assist with troubleshooting (↑Lehrer et al., 2019). In addition, decision-makers need to consider that malfunctioning hardware may take time to repair, and pathways to ensure learning continuity must be designed (e.g., ensuring content that is created is compatible with both IWBs and physical use when there is an issue with the technology).

5.4. Decisions around hardware and software cannot be made in a vacuum

Often, teachers bear the burden of ill-planned investments without any support structures. User inputs on the hardware must be considered during the design and implementation phases. A comprehensive situational analysis, which takes into account user capabilities, prior knowledge, and experience with IWBs, as well as an analysis of existing

digital infrastructure (including internet connectivity, access to devices, etc.), must be conducted to influence the selection of hardware and accompanying software. Additionally, the high costs of installation, maintenance, and training can raise concerns about overall cost-effectiveness, especially when the technology is underused (↑Cengiz, 2020; ↑Tombak & Ateskan, 2019).

5.5. Pedagogical and content alignment is key

Digital content for IWBs should be aligned with the broader national curriculum, and teacher training on how to integrate digital content into everyday pedagogy must be a key area of focus. While IWBs have interactive potential, they can sometimes reinforce traditional, teacher-centred methods if used mainly for display. Initial engagement may stem from the novelty of the technology, but sustaining it requires ongoing, varied use. Research shows mixed effects on student achievement, emphasising that outcomes depend on how IWBs are used. IWBs' effectiveness also varies by subject, with greater benefits observed in visually rich subjects, such as geography and English, and less in subjects like mathematics, where interaction may be more challenging (↑Hedberg & Freebody, 2007; ↑Higgins et al., 2007). A study by ↑Hennessy (2017) highlights that teacher-led professional development can be effective when learning about and implementing new hardware like IWBs. Such practitioner-led inquiry can enable teachers to contextualise technology use, reflect on its effectiveness, and adapt teaching practice and IWB use based on student needs. In addition, school leaders play a vital role in guiding teacher learning through modelling, mentoring, and providing feedback, which highlights the importance of training not just for teachers but also for school leaders.

6. Areas for future research

This section outlines potential areas for future research. While there is strong evidence that points towards the potential to use IWBs to support better teaching and learning practices, there are still areas where additional evidence and research are required. This includes building the evidence around scaling IWB use and its use for learners with SEND.

6.1. Build on existing research and evidence on the use of IWBs at a national scale

Additional research on the FATİH project in Turkey, especially a large-scale impact evaluation, could be beneficial for those seeking to learn more about the use of IWBs to improve both student and teacher engagement and learner outcomes. While there are numerous small-scale studies (mainly by Turkish researchers and academics), additional funding or capacity for an impact evaluation that takes into account additional factors such as learners with SEND and refugee access and learning could be beneficial. In addition, a detailed meta-review with updated data on the FATİH project, both from the Turkish government and other implementing partners, could be useful.

6.2. Build the evidence base on the use of IWBs and their impact on learners with SEND and refugee learners

There are few rigorous or large-scale studies on the impact of using IWBs specifically in refugee and host-country settings and for learners with SEND. While research on the use of IWBs exists, a significant number of research papers focus on IWB use in high-income countries. For IWB use in LMICs, research is limited in scope and scale. There is very little research on the use of IWBs, specifically for refugee learners and learners with SEND. Existing studies do not differentiate or highlight specific challenges refugee learners might face while using IWBs. Investing in specific, targeted research on the use of IWBs by refugee learners, learners with SEND, and their teachers is needed to fill this gap.

6.3. Focus specifically on IWB use and factors required to increase student learning outcomes

Rigorous, evidence-based research, specifically on the use of IWBs to increase student learning outcomes, is also missing. Most of the research highlighted as part of this scan focuses on student and teacher engagement with IWBs in the short term. While this is an important point of consideration for the use of IWBs, it is also necessary to explore the mechanisms for how educational technology, such as IWBs, supports the improvement of student learning outcomes over a sustained period of time, especially in LMICs, low-resource settings, and/or with refugee learners. In addition, a focus on specific learner-centred training, which is vital to engage teachers and school leaders, could be a key area of future research.

References

These references are available digitally in our evidence library at https://docs.edtechhub.org/lib/CX69MGVD

Abdul Monim, R. (2015). The status and obstacles of using interactive smart board from the point view of tutors at UNRWA schools according to experience years and specialty at west Gaza region in Palestine. *Al-Aqsa University Journal*, *19*(2). https://www.researchgate.net/publication/338083938_The_status_and_obstacles_of_using_interactive_smart_board_from_the_point_view_of_tutors_at_UNRWA_schools_according_to_experience_years_and_specialty_at_west_Gaza_region_in_Palestine. (details)

Abuhmaid, A. (2014). Teachers' perspectives on interactive whiteboards as instructional tools in four Jordanian schools. *Contemporary Educational Technology*, *5*, 73–89. https://doi.org/10.30935/cedtech/6116. (details)

Akar, H. (2020). The effect of smart board use on academic achievement: A meta-analytical and thematic study. *International Journal of Education in Mathematics, Science and Technology*, *8*(3), 261–273. https://doi.org/10.46328/ijemst.v8i3.908. Available from https://www.researchgate.net/publication/341443187_The_Effect_of_Smart_Board_Use_on_Academic_Achievement_A_Meta-_Analytical_and_Thematic_Study. (details)

Aldhafiri, M. D. (2020). The effectiveness of using interactive white boards in improving the Arabic listening skills of undergraduates majoring in Arabic language at Kuwaiti universities. *Education and Information Technologies*, *25*(5), 3577–3591. https://doi.org/10.1007/s10639-020-10107-5. (details)

Alghamdi, A. H. (2018). *Teachers in Tatweer Primary Schools in Saudi Arabia and Interactive White Boards: Towards a Professional Development Model*. Durham University. Available from https://etheses.dur.ac.uk/12985/1/5__Azzah_Final_Version_Thesis.pdf?DDD29+. (details)

Alhumsi, M. H. (2024). Revolutionizing EFL instruction: Jordanian teachers' perspectives on interactive whiteboards for word identification enhancement. *Journal of Intercultural Communication*, *24*(2), 70–81. https://doi.org/10.36923/jicc.v24i2.562. Available from https://immi.se/index.php/intercultural/article/view/562. (details)

Bathanti, J., & Abdul-Hamid, H. (2023). Strengthening digital education systems in Türkiye for the COVID-19 pandemic and beyond. *World Bank Group*. https://documents1.worldbank.org/curated/en/099011124154622231/pdf/P1756021920ca60d7194a51c15baf96c8f4.pdf. (details)

Cengiz, E. (2020). A thematic content analysis of the qualitative studies on FATIH project in Turkey. *Journal of Theoretical Educational Science*, *13*(1), 251–276. https://doi.org/10.30831/akukeg.565421. Available from https://dergipark.org.tr/en/pub/akukeg/issue/50135/565421. (details)

Çiftçi, S., Taşkaya, S., & Alemdar, M. (2013). The opinions of classroom teachers about FATIH project. *Ilköğretim Online*, *12*(121). https://files.eric.ed.gov/fulltext/EJ1192824.pdf. (details)

Condie, R. (2007). The impact of ICT in schools, a landscape review, Becta. *Http://Publications.Becta.Org.Uk/Download.Cfm?resID=28221*. https://cir.nii.ac.jp/crid/1571698600627989760. (details)

Cutrim Schmid, E., & Whyte, S. (2012). Interactive whiteboards in state school settings: Teacher responses to socio-constructivist hegemonies. *Language Learning & Technology*, *16*(2), 65–86. https://www.lltjournal.org/item/10125-44287/. (details)

CyberSmart Africa. (n.d.). *What we do*. CyberSmart Africa. Retrieved September 2, 2025, from https://www.cybersmartafrica.org. (details)

CyberSmart Africa. (2011, April 13). *CyberSmart Africa Training for Classroom Instruction in Rural Senegal: School Leader Interviews* [Video recording]. https://www.youtube.com/watch?v=zZJig1mqogE. Available from https://www.youtube.com/watch?v=zZJig1mqogE. (details)

Dahya, N., & Dryden-Peterson, S. (2016). Tracing pathways to higher education for refugees: The role of virtual support networks and mobile phones for women in refugee camps. *Comparative Education*, *53*(2), 1–18. https://www.researchgate.net/publication/311342237_Tracing_pathways_to_higher_education_for_refugees_the_role_of_virtual_support_networks_and_mobile_phones_for_women_in_refugee_camps. (details)

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008. Available from https://www.jstor.org/stable/249008. (details)

Dhindsa, H. S., & Shahrizal-Emran. (2011). Using interactive whiteboard technology-rich constructivist learning environment to minimize gender differences in chemistry achievement. *International Journal of Environmental and Science Education*, *6*(4), 393–414. https://psycnet.apa.org/record/2013-01402-005. (details)

Drigas, A., & Papanastasiou, G. (2014). Interactive White Boards in Preschool and Primary Education. *International Journal of Online and Biomedical Engineering (iJOE)*, *10*(4), 46–51. https://doi.org/10.3991/ijoe.v10i4.3754. Available from https://online-journals.org/index.php/i-joe/article/view/3754. (details)

Erdener, K. (2021). Students' attitudes towards using interactive whiteboard in mathematics classrooms. *International Journal of Technology in Teaching and Learning*, *17*(2), 84–94. https://eric.ed.gov/?id=EJ1330728. Available from https://eric.ed.gov/?id=EJ1330728. (details)

Gillen, J., Staarman, J. K., Littleton, K., & Mercer, N. (2007). A 'learning revolution'? Investigating pedagogic practice around interactive whiteboards in British primary classrooms 1. *Learning, Media and Technology*, *32*(3). https://doi.org/10.1080/17439880701511099. Available from https://www.researchgate.net/publication/45163384_A_'learning_revolution'_Investigating_pedagogic_practice_around_interactive_whiteboards_in_British_primary_classrooms_1. (details)

Hedberg, J., & Freebody, K. (2007). Towards a disruptive pedagogy: Classroom practices that combine interactive whiteboards with TLF digital content. *The Learning Federation*. https://www.academia.edu/17495067/Towards_a_disruptive_pedagogy_Classroom_practices_that_combine_interactive_whiteboards_with_TLF_digital_content. (details)

Hennessy, S. (2017). International experiences with intergrating interactive whiteboards: Policy, practice, pedagogy and professional development. In *Life in schools and classrooms: past, present and future* (pp. 633–650). https://www.researchgate.net/publication/316723279_International_Experiences_with_Intergrating_Interactive_Whiteboards_Policy_Practice_Pedagogy_and_Professional_Development. (details)

Hennessy, S., & London, L. (2013). Learning from international experiences with interactive whiteboards. *OECD*. https://www.oecd.org/en/publications/learning-from-international-exp

eriences-with-interactive-whiteboards_5k49chbsnmls-en.html. (details)

Hennessy, S., D'Angelo, S., McIntyre, N., Koomar, S., Kreimeia, A., Cao, L., Brugha, M., & Zubairi, A. (2022). Technology use for teacher professional development in low- and middle-income countries: A systematic review. *Computers and Education Open*, *3*, 100080. https://doi.org/10.1016/j.caeo.2022.100080. Available from https://www.sciencedirect.com/science/article/pii/S2666557322000088. (details)

Higgins, S., Beauchamp, G., & Miller, D. (2007). Reviewing the literature on interactive whiteboards. *Learning, Media and Technology*, *32*(3), 213–225. https://doi.org/10.1080/17439880701511040. (details)

Ildikó, P., & Szabo, T. (2018, November). *Interactivity in learning materials for the teaching*. ICETA 2018 - 16th International Conference on Emerging eLearning Technologies and Applications. https://doi.org/10.1109/ICETA.2018.8572208. Available from https://www.researchgate.net/publication/329044272_Interactivity_in_Learning_Materials_for_the_Teaching. (details)

Ishtaiwa, F., & Shana, Z. (2011). The use of interactive whiteboard (IWB) by pre-service teachers to enhance Arabic language teaching and learning. *Learning and Teaching in Higher Education: Gulf Perspectives*, *8*. https://doi.org/10.18538/lthe.v8.n2.65. (details)

Kılıç, E., Güler, Ç., Çelik, H. E., & Tatli, C. (2015). Learning with interactive whiteboards. *Interactive Technology and Smart Education*, *12*(4), 285–297. https://doi.org/10.1108/ITSE-05-2015-0011. Available from https://www.researchgate.net/publication/284205846_Learning_with_interactive_whiteboards. (details)

Kühl, T., & Wohninsland, P. (2022). Learning with the interactive whiteboard in the classroom: Its impact on vocabulary acquisition, motivation and the role of foreign language anxiety. *Education and Information Technologies*, *27*(7), 10387–10404. https://doi.org/10.1007/s10639-022-11004-9. (details)

Karthigesu, K., & Mohamad, M. (2020). Primary school teachers' perceptions on the integration of interactive whiteboard (IWB) during reading instructions. *International Journal of Academic Research in Business and Social Sciences*, *10*(2), 722–741. https://hrmars.com/index.php/IJARBSS/article/view/6977/Primary-Scho

ol-Teachers-Perceptions-on-the-Integration-of-Interactive-Whiteboard-IWB-during-Reading-Instructions. (details)

Kirbaş, A. (2018). Student views on using smart boards in Turkish education. *Universal Journal of Educational Research*, *6*(5), 1040–1049. https://www.researchgate.net/publication/327326104_Student_Views_on_Using_Smart_Boards_in_Turkish_Education. (details)

Kuo, F.-O., Yu, P.-T., & Hsiao, W.-H. (2015). Develop and evaluate the effects of multimodal presentation system on elementary student learning effectiveness: Within classroom English learning activity. *Procedia — Social and Behavioral Sciences*, *176*, 227–235. https://doi.org/10.1016/j.sbspro.2015.01.465. Available from https://www.sciencedirect.com/science/article/pii/S1877042815005029. (details)

Le Lant, C., & Lawson, M. J. (2015). Interactive whiteboard use and student engagement. *Australian Association for Research in Education*. https://www.researchgate.net/publication/306392494_Interactive_Whiteboard_Use_and_Student_Engagement. (details)

Lehrer, K., Mawoyo, M., Butcher, N., & Mbaye, S. (2019). *The impacts of interactive smartboards on learning achievement in Senegalese primary schools*. https://www.3ieimpact.org/sites/default/files/2019-01/GFR-PW2.14-NEPAD-Senegal-e-school.pdf. (details)

Leomoi, O. (2025). Critical perspectives on the use of technology with refugees and displaced communities: The case of Dadaab. *Journal of Interactive Media in Education*, *2025*(1). https://doi.org/10.5334/jime.875. Available from https://jime.open.ac.uk/articles/10.5334/jime.875. (details)

Luo, Z., Tan, X., He, M., & Wu, X. (2023). The Seewo interactive whiteboard (IWB) for ESL teaching: How useful it is? *Heliyon*, *9*(10). https://doi.org/10.1016/j.heliyon.2023.e20424. Available from https://www.cell.com/heliyon/abstract/S2405-8440(23)07632-6. (details)

Masnun, Baharun, S., & Syakur, S. A. (2025). Interactive whiteboard as a medium for Nahwu learning: Bridging technology and Arabic grammar education. *International Journal of Arabic Language Teaching*, *7*(01), 1–20. https://doi.org/10.32332/ijalt.v7i01.9977. Available from https://e-journal.metrouniv.ac.id/IJALT/article/view/9977. (details)

Mercer, N., Hennessy, S., & Warwick, P. (2010). Using interactive whiteboards to orchestrate classroom dialogue. *Technology Pedagogy and Education*, *19*(2), 195–209. https://www.researchgate.net/publication/254369573_Using_interactive_whiteboards_to_orchestrate_classroom_dialogue. (details)

Milla, A. C., Kurt, O., & Mataruna-Dos-Santos, L. J. (2019). User perceptions of technology integration in schools: Evidence from Turkey's FATIH project. *International Journal of Education and Practice*, *7*(4), 430–437. https://doi.org/10.18488/journal.61.2019.74.430.437. Available from https://archive.conscientiabeam.com/index.php/61/article/view/613. (details)

Moss, G., Jewitt, C., Levaãiç, R., Armstrong, V., Cardini, A., & Castle, F. (2007). The interactive whiteboards, pedagogy and pupil performance evaluation: An evaluation of the Schools Whiteboard Expansion (SWE) Project (London Challenge). *University of London Institute of Education*. https://discovery.ucl.ac.uk/id/eprint/1520127/. (details)

O'Donnell, C. (2015). Getting on board: Investigating the opinions and attitudes of ESL teachers on the use of interactive whiteboards in the ESL classroom. *Culminating Projects in English*. https://repository.stcloudstate.edu/engl_etds/16. (details)

Olaimat, A., Al-Saud, A., & Al-Hussien, E. (2022). The degree to which Arabic language teachers in government schools in Al Balqa governorate having the skills of an interactive whiteboard from their point of view in light of some variables. *Dirasat: Educational Sciences*, *49*(1), 405–420. https://doi.org/10.35516/edu.v49i1.727. Available from https://www.researchgate.net/publication/362709125_The_degree_to_which_Arabic_language_teachers_in_government_schools_in_Al_Balqa_governorate_having_the_skills_of_an_interactive_whiteboard_from_their_point_of_view_in_light_of_some_variables. (details)

Ostermann, S. (2015, February 4). *Innovation: Instant Network Schools open up a new world for Somali refugees*. United Nations High Commissioner for Refugees. https://www.unhcr.org/news/stories/innovation-instant-network-schools-open-new-world-somali-refugees. (details)

Salem, S. F. K., & Salem, S. O. G. (2016, December 5). *The role of teacher self efficacy and school management system on teachers' intention to use interactive whiteboard (IWB) at high schools in Gaza Strip — TAM*

model approach. 1st International Conference on Global Business, Entrepreneurship and Creative Industry (ICGBEC 2016), Kuala Lumpur, Malaysia. https://www.researchgate.net/publication/314231679_The_Role_of_Teacher_Self_Efficacy_and_School_Management_System_on_Teachers'_Intention_to_Use_Interactive_Whiteboard_IWB_at_High_Schools_in_Gaza_Strip_-_TAM_Model_Approach. (details)

Saltan, F. (2019). The new generation of interactive whiteboards: How students perceive and conceptualize? *Participatory Educational Research*, *6*(2), 93–102. https://eric.ed.gov/?id=EJ1236334. Available from https://eric.ed.gov/?id=EJ1236334. (details)

Samsonova, O. (2017). *Understanding elementary teachers' experiences and views using interactive whiteboards for pedagogical practices*. https://www.researchgate.net/publication/333420917_Understanding_Elementary_Teachers'_Experiences_and_Views_Using_Interactive_Whiteboards_for_Pedagogical_Practices. (details)

Samsonova, O. (2018). Elementary teachers' uses and perceptions of interactive whiteboards for instruction. *International Journal of Learning Teaching and Educational Research*, *17*(8), 17–35. https://doi.org/10.26803/ijlter.17.8.2. Available from https://www.researchgate.net/publication/327500599_Elementary_Teachers'_Uses_and_Perceptions_of_Interactive_Whiteboards_for_Instruction. (details)

Samsonova, O. (2021). Educational technology in Abu Dhabi public schools: Teaching with interactive whiteboards (IWBs). *International Journal of Technology Enhanced Learning*, *13*(1), 60–77. https://doi.org/10.1504/IJTEL.2021.10032781. Available from https://www.researchgate.net/publication/337672813_Educational_Technology_in_Abu_Dhabi_Public_Schools_Teaching_with_Interactive_Whiteboards_IWBs. (details)

Shams, N., & Dabaghi, A. (2014). Iranian EFL learners L2 reading comprehension: The effect of online annotations via interactive white boards. *Journal of English Language Teaching and Learning*. https://www.academia.edu/116629597/Iranian_EFL_Learners_L2_Reading_Comprehension_The_Effect_of_Online_Annotations_via_Interactive_White_Boards. (details)

Türel, Y. K. (2012). Teachers' negative attitudes towards interactive whiteboard use: Needs and problems. *İlköğretim Online*, *11*(2). https://www.researchgate.net/publication/267203009_Teachers%27_Negative_Attitudes_towards_Interactive_Whiteboard_Use_Needs_and_Problems. (details)

Türel, Y. K., & Demirli, C. (2010). Instructional interactive whiteboard materials: Designers' perspectives. *Procedia — Social and Behavioral Sciences*, *9*, 1437–1442. https://doi.org/10.1016/j.sbspro.2010.12.346. Available from https://www.sciencedirect.com/science/article/pii/S1877042810024511. (details)

Tender Impulse. (2023, July 18). *List of Jordan Tenders — Government & Business Opportunities*. Tender Impulse. https://tenderimpulse.com/all-tender-list-from-country/get-jordan-tenders/2023-07-18/1. (details)

Tombak, C., & Ateskan, A. (2019). Science teachers' beliefs and attitudes towards the use of interactive whiteboards in education. *Journal of Turkish Science Education*, *16*, 394–414. https://doi.org/10.12973/tused.10290a. (details)

Torff, B., & Tirotta, R. (2010). Interactive whiteboards produce small gains in elementary students' self-reported motivation in mathematics. *Computers & Education*, *54*(2), 379–383. https://doi.org/10.1016/j.compedu.2009.08.019. Available from https://www.sciencedirect.com/science/article/pii/S0360131509002152. (details)

Trucano, M. (2011, October 19). Using ICTs in schools with no electricity. *World Bank Blogs*. https://blogs.worldbank.org/en/education/off-the-grid. (details)

Tsayang, G., Batane, T., & Majuta, A. (2020). The impact of interactive smart boards on students' learning in secondary schools in Botswana: A students' perspective. *International Journal of Education and Development Using Information and Communication Technology*, *16*(2), 22–39. Available from https://eric.ed.gov/?id=EJ1268872. (details)

Tunaboylu, C., & Demir, E. (2016). The effect of teaching supported by interactive whiteboard on students' mathematical achievements in lower secondary education. *Journal of Education and Learning*, *6*, 81–94. https://doi.org/10.5539/jel.v6n1p81. (details)

UNRWA. (2024, October 9). *Supply of Interactive Flat Panels for UNRWA Schools — (Only Jordan Local Vendors)*. United Nations Global Marketplace. https://www.ungm.org/Public/Notice/249216. (details)

United Nations Relief and Works Agency for Palestine Refugees in the Near East. (2022). *UNRWA Strategy on Information and Communication Technologies for Education (ICT4E) 2022*. https://www.unrwa.org/newsroom/press-releases/unrwa-launches-its-ict-education-ict4e-strategy. (details)

Wong, K., Russo, S., & McDowall, J. (2012). Understanding early childhood student teachers' acceptance and use of interactive whiteboard. *Campus-Wide Information Systems*, *30*(1), 4–16. https://doi.org/10.1108/10650741311288788. Available from http://www.emerald.com/ijilt/article/30/1/4-16/25752. (details)

Wong, M. M. W. (2009). *Smart reading instruction for ESL learners in the content area : SMARTboards and interactive learning*. https://doi.org/10.14288/1.0078052. Available from https://open.library.ubc.ca/soa/cIRcle/collections/graduateresearch/42591/items/1.0078052. (details)