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Adopting open textbooks in Moroccan secondary physics and chemistry education: a case study

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Identified as the single most predominant curriculum delivery vehicle in schools, textbooks not only play a crucial role in disseminating knowledge and organising learning objectives but also reflect learning approaches and curricular orientations. In Morocco, as in many developing countries, the process of updating textbooks is often slow and struggles to keep pace with rapid technological advancements, resulting in significant gaps in students' learning experiences, especially for physics and chemistry, which require experimental material and contemporary examples. The rise of digital educational resources, such as Open Educational Resources (OERs) and open textbooks, presents an opportunity to address these challenges by offering a more accessible, dynamic and regularly updated version of this indispensable teaching material. This study investigates the impact of adopting an open textbook dedicated to the physics and chemistry course at the scientific common core level in the secondary cycle (K–12) in Morocco on student learning outcomes by providing a qualitative and quantitative analysis involving a sample of 160 students over two academic years 2022/2023 and 2023/2024. Data were collected using a questionnaire developed around the four components of the COUP (Cost, Outcomes, Usage and Perceptions) framework. Results have shown positive feedback from students praising the accessibility, affordability and interactive features of the open textbook, enriching their learning experiences and helping to improve their academic performance.

Keywords: open textbooks; K–12 education; OER; Open Educational Practices; openness

Introduction

Over the past two decades, education and science have been profoundly transformed by the concept of openness, which refers to evolving ideas about the future of knowledge creation and sharing (Friesike et al., 2015; Gaskell & Mills, 2015). Beyond simply offering free access, openness took shape when UNESCO defined Open Educational Resources (OERs) in 2002 as teaching, learning and research materials available in the public domain or under licences allowing free access, use, adaptation and

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redistribution (UNESCO, 2002). UNESCO's recommendations highlight OER as a powerful tool for providing high-quality, sustainable course materials. By combining OER with effective pedagogy and diverse learning activities, educators and learners can more actively participate in education and content creation in inclusive knowledge societies (Huang et al., 2020).

Open textbooks, a key form of OER, are funded, published and licenced for free use, adaptation and distribution. These resources range from digitised versions of print materials to interactive digital formats, harnessing the medium's capabilities (Farrow et al., 2020; Fischer et al., 2015). Authored by experts and peer-reviewed, open textbooks offer the same quality as traditional ones. Their openness allows educators to customise content to meet specific student needs by reordering chapters, adding or removing sections, or incorporating supplementary material. This flexibility encourages collaboration amongst educators, fostering the creation of innovative teaching practices known as Open Educational Practices (OEPs) (Van Allen & Katz, 2023; Wiley & Hilton, 2018).

Open textbooks have been available for two decades, and some instructors, departments and institutions have redesigned courses and curricula to include or rely entirely on OER. However, the adoption of open textbooks is a complex and multifaceted process that includes technical considerations such as the Internet access in schools and the availability of the necessary equipment. Successful adoption also depends on the digital skills of both teachers and students; teachers need to use appropriate pedagogical methods to maximise the benefits of open textbooks, whilst students need digital literacy skills to engage effectively with these materials (Huang et al., 2020).

This study investigates the adoption of an open textbook dedicated to the physics and chemistry course at the scientific common core level in the secondary cycle, offering experimental activities, lessons with examples and exercises, as well as course supplements incorporating links to quizzes, animations and videos. Developed under a Creative Commons open licence and reviewed by subject inspectors, the open textbook incorporates reused and remixed existing resources as well as newly created content that conforms to official Moroccan curriculum guidelines. This study also assesses the impact of open textbooks on student learning outcomes in Moroccan secondary education, by examining several key aspects: How and in what formats do students access required textbooks? What is the impact of textbook cost on course enrolment, persistence and performance? How do students use open textbooks in their studies? How do students perceive open textbooks, and what is their willingness to continue using them? By combining quantitative and qualitative data, this study provides a comprehensive analysis that provides a baseline understanding of the use of open textbooks in secondary education.

Limitations of traditional textbooks in the Moroccan context

Whilst traditional textbooks have constituted a key element of Moroccan education for decades, several limitations impede their efficacy, particularly in the context of today's rapidly evolving educational landscape.

In Morocco, textbooks are typically revised and updated to align with educational reforms or changes in the school curriculum. The implementation of these reforms may span several years. To illustrate, the most recent significant curriculum reform, which resulted in the requisite textbook revisions, was implemented as part of the 'Emergency Plan' (2009–2012). Subsequently, further reforms have been initiated with

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the 'Strategic Vision 2015–2030 for Education' (CSEFR, 2015). The revision of textbooks is contingent upon the coordination of the Ministry of Education, publishers and teachers (Llorent-Bedmar, 2014). However, the content of textbooks is not updated with sufficient regularity. This is particularly problematic in rapidly evolving fields such as science and technology, as a significant proportion of exercises and examples included in the curriculum are no longer aligned with current standards, particularly in areas like technological innovations, energy transition and climate change. This discrepancy has the effect of rendering the curriculum less relevant to students. The integration of innovative pedagogical strategies, such as project-based learning, flipped classrooms or lab activities, is not sufficiently reflected in the content or structure of Moroccan textbooks.

On the other hand, the rising cost of textbooks can be a significant financial burden for low-income families. To reduce inequalities in education, the Moroccan government has sometimes introduced subsidies to keep prices affordable. However, despite these efforts, textbook prices remain a concern for many families. Beyond these inconveniences in the Moroccan context, there are broader concerns associated with textbooks in general. Traditional textbooks offer little flexibility in terms of interaction, adaptability and accessibility. Furthermore, their production significantly contributes to deforestation, raising important environmental concerns.

The rise of open textbooks: Issues, policies and impact on education

Textbooks have been described as the 'oldest technology' in education (Jobrack, 2012). Research suggests that well-designed science textbooks can significantly enhance student understanding by effectively linking theory and practice (Chambliss & Calfee, 1989). Beyond simply disseminating information, textbooks play an important role in the implementation of educational policies and reflect the educational approaches adopted.

The open movement, initially focused on postsecondary education, is increasingly being adopted in K-12 settings. The U.S. has led OER adoption in K-12 levels, aiming to enhance access and reduce costs for students (Altbach et al., 1991; Tennant et al., 2019). A report from the International Association for K-12 Online Learning detailed OER-friendly policies in several U.S. states (Bliss & Patrick, 2013). Particularly, California and Texas have implemented favourable policies, promoting widespread OER adoption in secondary education (Robinson et al., 2014). Notably, some U.S. high schools have used OER exclusively across their entire curriculum since 2009 (Tonks et al., 2013). From 2010 to 2012, science teachers in a Utah school district piloted the adoption of open science textbooks in biology, chemistry and earth systems courses, with thousands of students using the open replacements for traditional science textbooks (Wiley et al., 2012). Although open textbooks can be distributed electronically and include multimedia content not normally available in traditional textbooks, this pilot project used printed versions of open textbooks that were similar in form and function to traditional textbooks. Even though the open textbooks are not used in digital form but printed for distribution, the cost per textbook is around 5$, which represents a significant difference compared with the cost of a traditional textbook.

In the African context, the potential of open textbooks is increasingly being recognised, as demonstrated by the Open Textbooks in South African Higher Education initiative, which mobilised various stakeholders to promote the transformation of curricula and address issues of social justice in the classroom (Digital Open

Textbooks for Development, 2021). The South African Institute for Distance Education (SAIDE) plays a key role in this effort by promoting equitable and meaningful access to knowledge and skills in sub-Saharan Africa. SAIDE has initiated several major projects in higher education, including OER Africa, launched in 2008, and recently Digital Open Textbooks for Development (DOT4D), which aims to analyse the open textbook publishing ecosystem to support openly licenced, localised content development approaches, curriculum transformation and cost alleviation in South African higher education institutions (Cox et al., 2022). At the secondary education level, the 'Siyavula' initiative (which means 'we open' in Nguni) has been set up to produce free open textbooks in science and mathematics classrooms to offset the shortfall in textbooks (Jimes et al., 2013).

In the Arab region, the current state of OER remains unclear. According to the Arab League Educational, Cultural and Scientific Organization (ALECSO), the Arab world's equivalent of UNESCO, covering 22 Arab countries to create and coordinate projects in the fields of education, culture and science, the Arab region lacks a clear vision or policy for OER adoption, with only a few countries making exceptions. Some countries, such as Saudi Arabia, with its specific OER program entitled 'The Saudi National OER program', concretised by the national OER platform 'Shms', have made significant strides (Tlili et al., 2020). Similarly, Bahrain has set up an OER policy mandating that all educational materials created by teachers, students and the Ministry of Education, along with publicly funded teaching resources, be licenced under CC BY-NC (Miao et al., 2019). Bahrain also hosts a popular OER repository, 'My Digital Library', offering course materials for primary and secondary students. In contrast, some countries still have not even started using OER, such as Comoros.

To further support OER accessibility in the Arab region, ALECSO created the OER Commons ALECSO Hub, grouping OER from the 22 Arab countries, where the user can add, search and download OER. In addition, to increase accessibility to education, ALECSO launched in 2013 the Open Book Project, which aims to develop open courseware in science and technology, as well as train educators to use and create OER (Jemni & Khribi, 2016). Furthermore, an examination of the literature reveals that multiple studies on students' perceptions of open textbook quality have consistently yielded positive findings (Clinton & Khan, 2019; Hilton III, 2020). Students appreciate the cost savings, accessibility, convenience and portability that open textbooks offer, as well as unique digital features such as multimedia and interactive learning supports. Most studies indicate that open textbooks are as effective as, if not slightly more effective than, traditional textbooks in terms of student learning outcomes (Oelfke et al., 2021). However, research also highlights that the use of OER in the global south still faces structural challenges. In addition to awareness and access, technical issues remain a major challenge. It is, therefore, crucial to provide an appropriate Information and Communication Technology (ICT) infrastructure in developing countries for better adoption of OER. In addition, the development of low-cost technologies to facilitate offline access to OER would increase their accessibility, particularly in rural areas where the Internet infrastructure is not established (Arcos & Weller, 2018).

The current landscape of open textbooks in Morocco

In Morocco, the adoption of digital technologies in education began in 1999 with the integration of ICT through the National Education Charter (Llorent-Bedmar, 2014). In 2005, the GENIE (Généralisation des Technologies de

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l'Information et de la Communication dans l'Enseignement) program was launched to integrate ICT to improve and enhance access and quality in primary and secondary education; it defines the key elements of an effective national policy on ICT in education, such as infrastructure, teacher training, development of digital resources and modernisation of teaching and learning practices. Subsequently, Morocco has further paved the way for digital and open approaches in its strategic vision for 2015–2030, in which the Higher Council for Education, Training and Scientific Research considers that the development of a diversified, open, efficient and innovative pedagogical and training model is a key lever in achieving the expected objectives of change. In this context, the Council suggests reinforcing the integration of educational technologies by developing a national strategy, which puts them at the service of quality learning on the curricula, programs and training levels since the early school years, thanks to various digital media, interactive programs and networks (CSEFR, 2015; HCETSR, 2015).

In 2016, Morocco established its first OER framework through the OpenMed project (https://openmedproject.eu), outlining a vision for open education based on seven key pillars: content, access, technology, research data, research outputs, licencing and policy (OpenMed, 2016). The declaration recommended combining initiatives and providing strategic support to integrate open education across all sectors. Since then, Moroccan universities have embraced OER, a movement accelerated by COVID-19, which highlighted the need to advance open textbook initiatives within educational institutions (Ouahib et al., 2022, 2023).

Subsequently, the report from the special commission on the new development model emphasises the growing risks of pandemics, raising concerns about risk management and ensuring pedagogical continuity in both normal and crisis times. The commission calls for renewing educational content and approaches, leveraging digital technology as a transformative force. It advocates developing a Moroccan Edtech ecosystem integrating companies and start-ups using new technologies to transform education and training and ensuring digital connectivity for all public schools (SCDM, 2021).

Since March 2020, in response to COVID-19, the Moroccan Ministry of Education launched the TelmidTICE (https://telmidtice.men.gov.ma/) distance learning platform to ensure continuity in K-12 education. Access to the platform became free in June 2020, without requiring an Internet connection. In November 2023, the Ministry introduced support courses via the platform and a free mobile app for all students. TelmidTICE provides over 12 500 digital resources, including 11 000 lessons, 1000 interactive exercises and 500 exam models, aligned with the national curriculum, highlighting Morocco's commitment to strengthening the use of new technologies in the educational process.

Method

This research aims to investigate the factors influencing the adoption of open textbooks and their impact on teaching and learning practices and on students' academic performance. Specifically, it focuses on an open textbook for the secondary physics and chemistry course designed for the science common core. This open textbook was developed under a Creative Commons open licence, and it incorporates reused and remixed existing resources as well as newly created content that conforms to the official Moroccan curriculum guidelines. The textbook, reviewed by subject inspectors,

includes detailed activities with questions, lesson summaries, exercises and links to animations and videos.

This study was conducted over two academic years with a sample of 160 students. In the academic year 2022/2023, two groups of 80 students used the traditional textbook and were taken as a reference group. In 2023/2024, two additional groups of 80 students used the open textbook. From the very first session of the school year, during which teachers explain the working method and establish the classroom charter, students were introduced to the use of the open textbook. A dedicated presentation was provided, and at the end of the session, a digital version was shared with the students along with a printed version, allowing them to make copies. This research adhered to the ethical standards commonly applied in social sciences and educational research. Data collection was conducted using a questionnaire that was thoroughly reviewed and validated by the Transdisciplinary Research group on Educative Innovation (TransERIE) at the Cadi Ayyad University in Morocco, ensuring its relevance and methodological rigour, and based on the COUP (Cost, Outcomes, Usage and Perceptions) framework to analyse various aspects of open textbook implementation. The COUP framework, developed by the Open Education Group (Ma, 2021), addresses the key educational factors most affected by OER. It provides insights into cost savings, improved access to up-to-date materials and the impact on learning outcomes and usage patterns, as well as students' perceptions of their readiness and motivation to adopt OER in the future.

The investigations were guided by the research questions outlined in the COUP framework:

- Cost: What is the financial impact of open textbooks compared with traditional textbooks on students' choices and behaviour?
- Outcomes: What impact has the implementation of open textbooks had on students' academic performance, including pass rates and dropout rates?
- Usage: What methods do students employ to utilise the open manual?
- Perceptions: How did students rate the quality of the open textbook compared to traditional textbooks used in other courses?

By the end of the school year 2023/2024, students were invited to evaluate their experience by completing the questionnaire voluntarily and anonymously to minimise bias. However, the data collection encountered some difficulties, as some students lacked the necessary equipment or Internet access, as well as the frequent occupation of the only multimedia room in the establishment. To overcome these constraints, a connected computer was made available to students wishing to participate.

Results

Characteristics of the survey sample

This study was conducted with two groups of 80 students enrolled in the scientific common core program, who utilised the open textbook as their course material in physics and chemistry classes. By the end of the 2023/2024 academic year, students were invited to participate in an anonymous questionnaire survey, through which they were asked to evaluate their learning experience.

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Table 1. Distribution of sample variables.

Dimension	Details	Ratio
Gender	Male	43%
	Female	57%
Monthly household income per month	Less than 300$	26.5%
	Between 300$ and 500$	29.7%
	Between 500$ and 700$	17.2%
	Between 700$ and 1000$	17.2%
	More than 1000$	9.4%
Number of siblings attending school	0	9.4%
	1	25%
	2	50%
	3 and more	15.6%
Material	Smartphone	89.1%
	Laptop	21.9%
	Tablet	1.6%
	I use other people's equipment	1.6%
	I don't have any equipment	1.6%
Internet connection volume per month	Unlimited access	51.6%
	Between 20Go and 10Go	4.7%
	Between 10Go and 5Go	10.9%
	Between 5Go and 1Go	21.9%
	Less than 1Go	6.3%
	I don't have regular Internet access	4.7%

The data indicate that 57% of the respondents were female. Amongst the respondents, 30% originated from middle-income households with a monthly income between $300 and $500, whilst 26% were from households with a monthly income of less than $300 per month. Moreover, 65.6% of the respondents had at least two siblings who were also enrolled in an educational institution. Despite the financial situation of the majority of students, 89% declared owning a smartphone; amongst them, 51% had unlimited Internet access, 43% had occasional access via mobile recharges and only 4.7% had no regular Internet access as shown in Table 1.

Financial impact of the open textbook

It is worthy of note that the cost of a traditional textbook covering physics and chemistry at the core science level, as well as the accompanying activity and exercise books, which are available for purchase separately, ranges from 20 to 27$. In contrast, the open textbook, which encompasses the course content, activities and exercises, in addition to supplementary multimedia and interactive content, is available at no cost in its electronic format and costs approximately 2$ in its printed version. This represents a tenfold difference in cost.

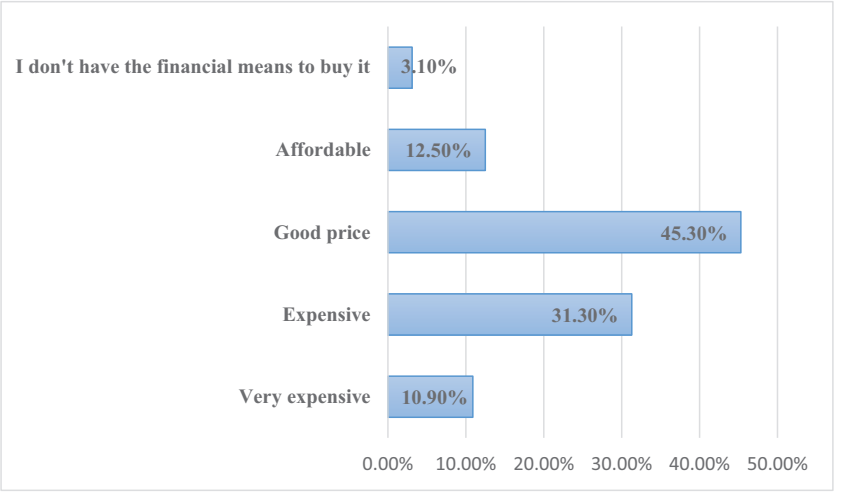

Figure 1. Students' assessment of the cost of traditional textbooks.

Figure 1 shows that 57.8% of students consider the price of the traditional textbook to be medium or affordable, whilst 42.2% find it expensive, and the remainder say they lack the financial means to afford it.

We also asked whether students had purchased traditional textbooks for other courses. 28% said they had not, whilst 72% confirmed that they had. However, only 35% of those who bought textbooks did so for all disciplines, as shown in Figure 2. For those who had not purchased textbooks, some explained this by financial constraints or by the fact that they thought the textbooks were useless, whilst others mentioned their very heavy and cumbersome nature.

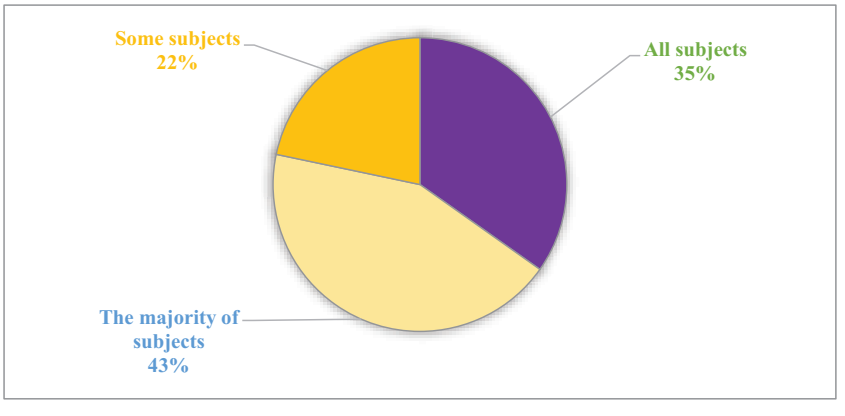

Figure 2. Subjects for which students purchased traditional textbooks.

Methods for student use of the open textbook

Students were asked to evaluate their use of the open textbook by comparing it to the traditional textbook. The results of this evaluation are shown in Figure 3.

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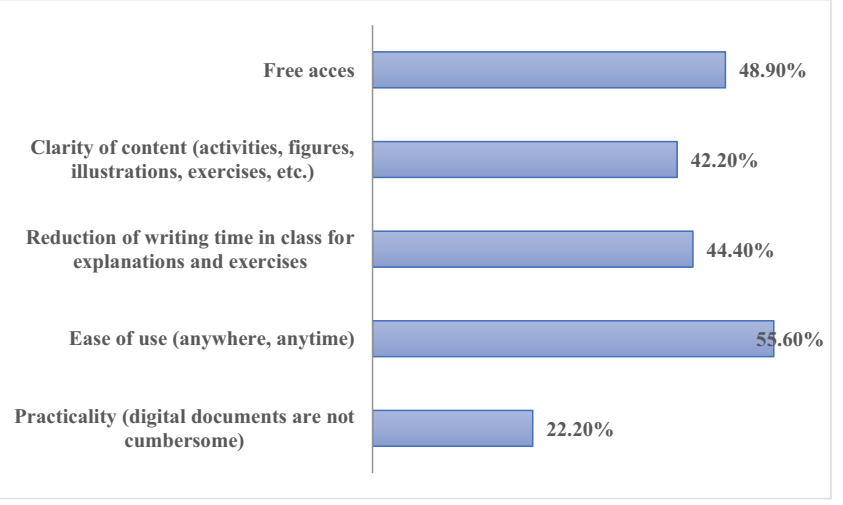

Figure 3. The advantages of the open textbook compared to the traditional textbook.

Students agreed on ease of use at 55.6%, free access at 48.9%, reduction of writing time in class for explanations and exercises at 44.4% and clarity of content at 42.2%, whilst 22.2% found the open textbook more practical than the traditional one.

Impact on students' academic performance

A first step in assessing the overall impact of the open textbook on students' academic performance consisted of collecting their perceptions of its effectiveness using a scale of one to five. The results showed that students rated the clarity of the content as 'effective' and the ease of use as 'very effective'. They also found the open textbook to be 'effective' in improving course retention and their grades in the discipline, as shown in Figure 4.

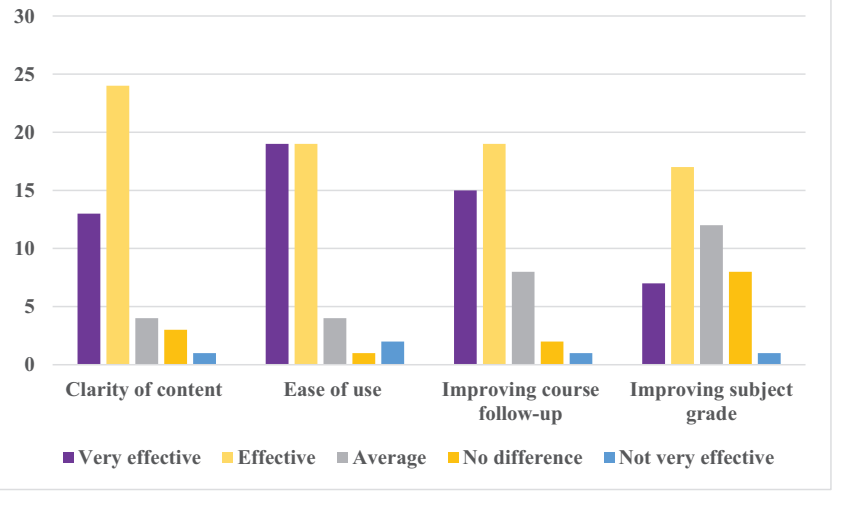

Figure 4. Perceived effectiveness of the open textbook.

Statistically, the academic performance was quantified based on a comparison of the two groups of students, which showed that the 2023/2024 group using the open textbook had a slightly higher number of students achieving an average grade (above 10/20) than the 2022/2023 group using the traditional textbook. This average was calculated from the results of three in-class examinations, complemented by a fourth assessment reflecting classroom activities (participation, homework, tutorials and practical sessions). Closely linked to class performance, a fundamental aspect is student engagement and the classroom environment. Students in the open textbook group showed greater commitment, participating actively in the activities, even in a context of massification (40 students per class), where managing overcrowded classes remains an annual challenge, since all students could follow the course, having access to the textbook in both digital and printed formats from the very first session. Conversely, the reference group showed less involvement. In addition, the reference group had a dropout rate of 3.75%, whilst the open textbook group had no dropouts.

Of note, the 2023/2024 cohort included one student with a physical disability that limited her ability to take notes in class and another with severe myopia. Both students were able to follow the course effectively using the summaries and activities provided in the open textbook.

Perceived quality of the open textbook

Upon inquiry as to whether the open textbook could serve as a replacement for the traditional one, 82.2% of students indicated their agreement. Furthermore, 77.8% of respondents expressed interest in applying this approach to other subjects. Nonetheless, 17.8% of respondents expressed opposition to this proposal, whilst 4.4% proposed a combination of traditional and open textbooks.

Moreover, students were requested to evaluate the quality of the open textbook on a scale of 1 to 10. The majority of students (80%) rated the textbook between 8 and 10, whilst a smaller proportion (13%) assigned it a 7, and a mere 7% rated it a 5.

Discussion

The main objective of this study was to evaluate various aspects of the use of an open textbook in a physics and chemistry course at the secondary level in Morocco according to the COUP framework, to assess the practicability of this type of course material on the one hand and to establish a baseline study to serve as a reference for extending this experiment to other classes and subjects on the other. The main findings of the study are discussed later.

Contrary to our expectations based on previous literature, the cost did not have such a significant impact, as the majority (57.8%) of students found it reasonable or affordable. However, the price of traditional textbooks, ranging from 70$ to 90$ per student across all subjects, remains a significant expense. This is particularly noteworthy given the average income of families, many of which have at least two students attending school. This can be understood in a socio-economic context that highlights the significant value that Moroccan families place on education. The start of each new school year is a major event on parents' agendas, but since public education does not require enrolment fees, parents express their willingness to buy textbooks as long as it is only once a year. On the other hand, only 35% of students who can afford traditional

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textbooks buy them for all subjects; the rest either buy textbooks for limited subjects, opt for used textbooks or borrow textbooks from older siblings or friends.

Whilst cost is often cited as a key advantage of open textbooks, their quality and sustainability are frequently considered as more significant factors. Researchers have identified several advantages associated with flexibility, learner-centred education, collaboration, knowledge sharing and continuous quality improvement (Griffiths et al., 2022; Mason & Kimmons, 2018; Wiley et al., 2012). It is, therefore, recommended that stakeholders shift their focus away from costs and prioritise benefits such as collaboration, differentiation and professionalisation (Kimmons, 2016). In the context of public schools in Morocco and potentially other African countries with minimal or no tuition fees, the cost of textbooks does not appear to be a significant factor influencing the adoption of open textbooks.

At the beginning of each academic year, there are frequent delays in the start of courses due to students lacking the required textbooks or joining the course after the term has begun. This issue was effectively resolved by providing students with access to the electronic version from the first day of class, fostering student commitment and discipline whilst helping to reduce the drop-out rate.

In examining the impact of the open textbook on student grades, the majority of students rated it as 'effective' or 'average', whilst a few reported no impact. This aligns with the statistical results comparing the two groups, which showed slightly higher marks for the open textbook group. Similarly, Hilton reviewed nine studies involving 46 149 higher education students and found that OERs generally do not appear to have a significant impact on learning outcomes in most cases (Hilton, 2016). Indeed, OERs do not seem to be a panacea for the multifaceted challenges confronting students, particularly in the context of K-12 education, where many students experience difficulties with subjects like physics and chemistry (Remillard, 2005; Stern & Roseman, 2004). The obstacles to learning can be attributed to a multitude of factors, including the discrepancy between the common core curriculum and prior academic standards, the challenges inherent in mastering the prerequisites for mathematics and physics, as well as orientation issues.

On the other hand, open textbooks have effectively expanded access for students with disabilities, supporting the Ministry's inclusion goals and aligning with UNESCO's Ljubljana OER Action Plan (Ljubljana, 2017), which promotes OER-based approaches to foster lifelong learning and advance SDG4, focused on inclusive, equitable and quality education for all.

Whilst open textbooks have been well studied in higher education (Hilton, 2020), understanding their impact on K-12 students is key to successful implementation at higher levels. Most students in our study preferred open textbooks, appreciating their free access, interactivity and up-to-date content. Students also appreciated the dynamic and personalised aspect, fostering a sense of participation and ownership in the learning process. Many students also supported extending this approach to other subjects, with some suggesting a combination of electronic and print versions.

Globally, in secondary education, open textbooks have proven to be effective, particularly in STEM subjects (Science, Technology, Engineering and Mathematics), and languages, where they are most commonly used. They offer significant pedagogical flexibility and can be adapted to various teaching approaches, as in the international initiative Blended Learning Open Source Science or Math Studies (BLOSSOMS), which developed a blended approach for its repository of educational high school math and science (Jimes et al., 2013).

Conclusion

In Morocco, as in most developing countries, an ongoing debate has always been taking place about the quality of education, the renewal of curricula and the adoption of innovative teaching methods. In the aftermath of the global COVID-19 pandemic, old challenges have been exacerbated, and new ones have arisen. However, other opportunities have been explored with the increasing shift to online learning, which has led to a greater sense that the time is ripe for boldly advancing the agenda of OER and open textbooks within and across institutions.

This study evaluated the implementation of an open textbook for the common core physics and chemistry courses in Moroccan secondary schools. Students provided positive feedback, citing cost-effectiveness, accessibility and convenience. Open textbooks proved to be a valuable alternative, supporting different learning modalities (online, blended, face-to-face) through digital features such as multimedia and interactive tools that enhance the learning experience. Overall, open textbooks were as effective or slightly more effective than traditional textbooks, promoting better outcomes and engagement, especially for students with disabilities, thus supporting equitable education and social justice (Delimont et al., 2016; Lambert & Fadel, 2022).

Conversely, the integration of OER into mainstream practice is impeded by a multitude of obstacles. These include a lack of awareness, technological challenges, quality concerns, copyright uncertainties, accessibility issues and the absence of comprehensive OER policies (Luo et al., 2020). An institutional commitment to open textbooks can serve as a crucial initial step in the integration of more OEPs. Institutional and ministry recognition and support of open textbooks can facilitate the creation of innovative educational models in which learners and educators collectively curate, reuse, revise, remix and redistribute content in a way that suits their specific knowledge needs. However, the advent of these new opportunities also presents novel challenges. In particular, educators must enhance their digital and pedagogical competencies through continuous training, institutional assistance and the establishment of comprehensive digital infrastructures.

Whilst this study reflects the promise of open textbook development and deployment as one of several pathways that will contribute to achieving education for all, it also has certain limitations, notably its application to a single level and subject, without an in-depth analysis of the pedagogical aspects. In addition, a slight margin of bias may exist due to the varying levels of digital literacy amongst students. However, this study opens up prospects for research into the pedagogical integration of open textbooks into other levels and subjects, as well as their potential for creating local content, particularly in non-STEM subjects such as literature and history.

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