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Using Open-Educational Resources (OERs) for Hyflex Learning in Limited Face-to-Face Science Instruction

RESEARCH ARTICLE

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ABSTRACT

This study investigated the effectiveness of Open Educational Resources (OERs) in enhancing science learning outcomes and student perceptions within a Hyflex instructional setup, characterized by limited face-to-face interaction. Using a quantitative one-group pretest-posttest quasi-experimental design, the research was conducted at Colegio de San Juan de Letran and involved 724 students from Grades 7 to 12. Participants completed pre- and post-tests in science, along with perception surveys administered before and after the OER intervention. Quantitative analysis revealed statistically significant improvements in post-test scores across all grade levels ($p < .001$), with effect sizes ranging from moderate ($d = 0.50$) to large ($d = 1.39$). These gains highlight the positive impact of OERs on student academic performance. In parallel, the Wilcoxon Signed-Rank Test on survey responses showed significant increases in student engagement, enjoyment, and perceived learning quality, with several items reaching very large effect sizes, particularly in Grades 8 and 9. The findings suggest that OERs are not only effective in promoting academic achievement but are also well-received by students in a flexible learning context. This research contributes to the growing literature advocating for OER adoption in secondary science education and underscores its value in supporting accessible, engaging, and high-quality instruction in blended learning environments.

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INTRODUCTION

In today's educational landscape, especially in basic education, science instruction must evolve to meet the demands of 21st-century learning. One of the pressing challenges teachers face is how to deliver meaningful and engaging lessons in flexible learning environments, particularly when face-to-face classroom time is limited. With the growing g need to transform pedagogy and address learning gaps, educators are now integrating technology into both virtual and physical classroom settings. This includes adopting a range of teaching strategies that encourage learners to apply new knowledge and develop critical thinking skills. Technology, when used appropriately, can improve instructional delivery and help students become informed, capable members of society (Bialo & Silvin-Kachala, 1996; Cotton, 1991; Means et al., 1995; Sheingold & Hadley, 1990). To realize its full potential, however, teachers must be equipped to select and effectively use digital tools that enhance learning, especially in subjects like science, which rely on inquiry, experimentation, and real-world application (Angeli & Valanides, 2005). This need is especially urgent in hybrid or Hyflex setups, where students alternate between in-person and online learning. Within this context, the present action research focuses on how Open Educational Resources (OERs) can support science instruction in a limited face-to-face (F2F) setting.

During the pandemic and beyond, Open Educational Resources (OERs) have emerged as valuable tools for teachers navigating online and blended learning environments. First introduced by UNESCO in 2002, OERs are freely accessible digital materials that can be used, adapted, and shared for teaching and learning (Johnstone, 2005). These include not only lesson content but also tools that assist in content creation, delivery, and collaboration. Widely used platforms such as Kahoot!, Canva, Flipgrid, Edmodo, Google Slides, and Quizizz—along with Web 2.0 tools like YouTube and Facebook—have made it easier for teachers to enhance instruction and share best practices (Neo et al., 2013). In science education, these tools can help explain abstract concepts, visualize data, conduct virtual experiments, and provide interactive learning experiences even when classroom time is limited.

OERs can be categorized into content (e.g., modules, videos, textbooks, quizzes) and tools (e.g., learning management systems, content creation software, repositories). They come in various formats—text, video, animation, and multimedia—and are often organized by their function, whether as directories, platforms (e.g., WikiEducator), or repositories. They are particularly effective in science subjects where dynamic materials and simulations can bridge the gap caused by reduced laboratory access or instructional time (UNESCO, 2009; JISC, 2013). The 5R framework—Retain, Reuse, Revise, Remix, and Redistribute—proposed by Wiley (2014), empowers teachers to adapt and customize content to meet learners' specific needs. In basic education science, this means teachers can tailor OER materials to match curriculum goals, simplify complex concepts, and accommodate different learning styles. Moreover, students benefit from increased access to quality resources, exposure to global perspectives, and opportunities for self-paced and peer-supported learning (Karunanayaka et al., 2016; Dhanarajan & Porter, 2013). This is especially helpful in science subjects where learners need multiple exposures to challenging topics.

Hyflex learning, developed by Beatty (2006), is an extension of blended learning that gives students the flexibility to participate in classes face-to-face, synchronously, or asynchronously. Its adoption is accelerated during the pandemic as schools sought flexible and equitable instructional models (Barr & Lou, 2025). In the Philippine context, where internet structure and access remain uneven, combining Hyflex with OERs provides a practical strategy for continuity of science learning. This study builds on the constructivist paradigm, emphasizing student-centered learning, and explores the roles of OERs in enhancing science instruction in Hyflex environments. It is one of the first studies in the Philippines to empirically test the integration of OERs in secondary science under limited F2F conditions post-pandemic.

The contribution of this study lies in demonstrating how OERs can improve the delivery and effectiveness of Hyflex science instruction in basic education. By focusing on a flexible setup with limited face-to-face engagement, the study offers insights into how digital resources can help maintain instructional quality and student engagement in science subjects. It responds to the growing need for practical, low-cost, and scalable solutions that support science learning in hybrid learning modalities. This study answers the question: To what extent do students' science test scores improve after the integration of OERs in a Hyflex learning environment? And to what extent do student's perceptions of learning change after the integration of OERs in a Hyflex learning environment? This study specifically aims to: (a) encourage and support the integration of Open Educational Resources (OERs) in Hyflex science instruction within a limited face-to-face learning environment in basic education. (b) assess the effectiveness of using OERs in enhancing student engagement, understanding of scientific concepts, and overall learning outcomes in science subjects delivered through a limited face-to-face Hyflex modality. As educational systems continue to adapt to hybrid models, understanding how to leverage OERs in science education becomes essential. This study seeks to guide educators, administrators, and policymakers in making informed decisions about technology integration in basic education, particularly in science classes that are foundational to students' future academic and career success.

LITERATURE REVIEW

CHALLENGES IN PHILIPPINE SCIENCE EDUCATION

The Philippines continues to face systemic challenges in science education, with students underperforming in international assessments (SEI-DOST & UP NISMED, 2011). Factors include curriculum misalignment, reliance on rote memorization, and poor integration of inquiry-based learning (Örnek et al., 2008). These challenges were magnified during the pandemic, when remote and hybrid learning exacerbated in access (Alvarez, 2020; Aboagye et al., 2020). For science education to be effective, it must relate to students' daily lives, aligning with their beliefs, practices, and interests. A competency-based approach that taps into learners' personal goals and lived realities could foster deeper engagement and motivation.

Research by the University of the Philippines National Institute for Science and Mathematics Education Development revealed that many Filipino students have a shallow understanding of basic scientific concepts (SEI-DOST & UP NISMED, 2011). This limited knowledge base hinders their ability to solve real-world problems or construct inquiry-based investigations. Moreover, students exhibit weak working memory, poor reasoning, limited analytical capabilities, and deficient communication skills. Since science serves as a foundational subject for environmental education, this deficiency reflects a broader systemic issue. The failure to establish robust science learning undermines the implementation of inquiry-based approaches in schools.

Further compounding the issue, Angeli and Valanides (2005) found that students perceive science as a difficult subject due to its heavy cognitive demands. The simultaneous use of diverse elements—such as equations, graphs, experiments, and abstract reasoning—contributes to their struggle. Additionally, a decline in student interest and enthusiasm is often observed when tackling complex concepts, such as electricity (von-Rhöneck et al., 2007).

OER AND HYFLEX LEARNING IN K-12 EDUCATION

Hyflex, rooted in blended learning traditions, has gained traction as a flexible model in diverse contexts (Beatty, 2006; Barr & Lou, 2025). Research shows its potential for increasing equity and adaptability, though challenges remain in instruction design and teacher readiness (Bozkurt, 2023; Mishra, 2025). The onset of the COVID-19 pandemic forced many educational systems worldwide to transition rapidly to online or remote learning. In the Philippines, this abrupt shift highlighted pre-existing educational inequities and introduced new barriers, such as limited access to technology and poor internet infrastructure (Alvarez, 2020; Mateo, 2020). Appana (2008) pointed out key challenges in online learning environments, including insufficient institutional support, unpreparedness of students and educators, and delays in teacher responses. Connectivity issues, as documented by Aboagye et al. (2020), further exacerbated students' learning difficulties.

Lack of access to learning materials and frequent power outages (Castillo, 2020) have also disrupted remote learning experiences, especially in low-resource communities. These conditions have made it difficult for students to fully participate in and benefit from online education.

Given these constraints, the use of Open Educational Resources (OERs) offers a promising alternative. OERs are freely accessible and customizable, reducing financial barriers and supporting differentiated instruction (Wiley, 2014). Studies show that OERs improve motivation, engagement, and outcomes (Hilton, 2016; Bliss et al., 2013b). Recent work has examined OER adoption in K-12, highlighting enablers and barriers (Klar, 2024), innovation potential (Farrow, 2024; Varma, 2023), and comparisons with traditional textbooks (Panday-Shukla, 2024).

Complementing OERs, Hyflex (hybrid-flexible) learning models provide students with the option to attend classes either in-person or online, synchronously or asynchronously. This learner-centered approach prioritizes accessibility and adaptability, allowing students to switch modalities based on their circumstances. Hyflex ensures that all learners receive consistent, high-quality instruction regardless of how they engage with the course content. It encourages autonomy while maintaining instructional rigor and inclusivity. While international literature is rich, few studies have explored OER-Hyflex integration in basic education in the Philippines. This study contributes by addressing this gap, focusing on MELCs-aligned OERs in science education.

THEORETICAL BACKGROUND

This study is grounded in Constructivist Learning Theory, which asserts that learners construct knowledge actively through experience, interaction, and reflection (Piaget, 1970; Vygotsky, 1978). Rather than being passive recipients of information, students learn best when they are engaged in meaningful tasks that connect new knowledge to prior understanding and real-world contexts.

In science education, constructivism emphasizes inquiry-based learning, problem-solving, and the application of concepts to everyday life. This perspective is especially relevant in the Philippine educational context, where traditional rote learning methods have been identified as a barrier to developing deeper conceptual understanding (SEI-DOST & UP NISMED, 2011). A constructivist approach calls for instructional methods that foster critical thinking, collaboration, and student autonomy—principles that align well with the use of Open Educational Resources (OERs) and HyFlex learning modalities.

OERs promote constructivist learning by offering flexible, adaptable, and accessible content that can be tailored to students' diverse learning needs and interests. When used effectively, these resources can support active learning, stimulate curiosity, and encourage learners to take ownership of their educational experiences. Moreover, the HyFlex learning model—which provides options for in-person, synchronous online, or asynchronous participation—supports the learner-centered ethos of constructivism by giving students agency over how they engage with content.

By situating this study within the constructivist paradigm, the integration of OERs in a HyFlex environment is understood not merely as a technological intervention, but as a pedagogical strategy aimed at transforming how science is taught and learned. This theoretical lens provides a foundation for examining the extent to which such an approach fosters meaningful engagement, improved conceptual understanding, and a more inclusive learning environment, particularly in the context of post-pandemic education in the Philippines.

METHODS

This section outlines the research design, instruments, participants, data collection procedures, and analytical strategies employed to evaluate the impact of Open Educational Resources (OERs) on students' science learning in a Hyflex instructional setup. Emphasizing a quantitative approach, the study was structured to capture both measurable academic outcomes and student perceptions across multiple grade levels. Attention was also given to ethical considerations, instrument validation, and methodological rigor to ensure the reliability and credibility of the findings.

RESEARCH DESIGN

This study employed a quantitative one-group pretest-posttest quasi-experimental design and a quantitative case study framework of a single bounded system to investigate the effectiveness of Open Educational Resources (OERs) in science instruction under a Hyflex learning setup. The quasi-experimental design enabled the researchers to evaluate learning outcomes through measurable differences between pre-test and post-test results, while the case study component provided contextual insights into the actual use of OERs in classroom instruction with limited face-to-face interaction. Further, this design allowed the researchers to capture both statistical changes and contextual insights. The absence of a control group is acknowledged as a limitation.

DATA COLLECTING TOOLS

Three primary instruments were utilized to collect data: (1) pre-tests and post-tests to assess students' conceptual understanding of science topics; (2) pre- and post-intervention perception surveys using Likert-scale items to evaluate students' views on the usefulness, accessibility, and engagement offered by OERs; and (3) a content alignment checklist to ensure that all selected OERs aligned with the Department of Education's Most Essential Learning Competencies (MELCs) and appropriate grade-level standards.

SAMPLING/STUDY GROUP

The study involved a census sample of 724 students enrolled in science subjects at Colegio de San Juan de Letran, representing all levels from Grade 7 to Grade 12. Specifically, the sample included 64 Grade 7 students, 66 from Grade 8, 79 from Grade 9, 88 from Grade 10, 165 from Grade 11, and 262 from Grade 12. All students who were part of the Hyflex science instruction program participated in the intervention. This ensured full population coverage, distinguishing it from random sampling. Pretests and posttests are aligned with science MELCs, Philippines' pandemic-era streamlined competencies, where content alignment checklist is also mapped. The Likert items for the perception surveys are scored 0.87 for Cronbach's alpha.

DATA ANALYSIS

Data were encoded and initially tabulated using Microsoft Excel (Version 16.97). For inferential statistics, R software (Version 4.4.1; R Core Team, 2024) was employed. To determine improvements in students' performance, paired sample t-tests were conducted comparing pre- and post-test scores. To analyze shifts in student perceptions of OERs before and after the intervention, the Wilcoxon Signed-Rank Test was used. Effect sizes were computed—Cohen's d for the t-tests and r-values for the signed-rank test—to interpret the magnitude of observed changes. Descriptive statistics such as means, standard deviations, and medians were also reported.

VALIDITY AND RELIABILITY

All instruments underwent expert validation by a panel of science educators to ensure clarity, content relevance, and alignment with curricular standards. The perception surveys were adapted from previously validated tools in OER-related research and were pre-tested for reliability. Test items were reviewed and revised accordingly to enhance internal consistency.

RESEARCH PROCEDURE

The study was implemented in phases. First, pre-tests and baseline surveys were conducted. Then, the OER-integrated instruction began, using resources aligned with Most Essential Learning Competencies (MELCS) from the Department of Education and delivered in a Hyflex learning modality. Upon completion of the intervention, students took post-tests and final perception surveys. All data were systematically collected, encoded, verified, and analyzed to determine both academic gains and perceptual shifts resulting from the OER experience.

ETHICAL CONSIDERATIONS

Ethical protocols were strictly followed – permissions were secured from the school administration, and informed consent was obtained from both students and their parents or guardians. Anonymity and confidentiality were observed throughout the study. Approval was also obtained from the MCU Ethics Review Board (MCUERB) protocol no. 2025-039.

LIMITATIONS

The study has several limitations. First, its single-school setting limits generalizability to broader contexts. Second, the lack of a control group makes it difficult to isolate the specific effects of OERs from other instructional variables. Third, self-reported survey responses may be influenced by biases such as social desirability. Finally, the short intervention period may not reflect the long-term effects of OER use on science learning outcomes and retention.

RESULTS

PRE- AND POST-TEST PERFORMANCE IN SCIENCE

Descriptive statistics were computed for each grade level to evaluate the impact of Open Educational Resources (OERs) on student performance in science. Table 1 presents the mean scores and standard deviations of the pre- and post-tests for each group. Across all grade levels, students demonstrated improved performance following the OER-integrated instruction.

Table 1 Pre- and Post-Test Performance by Grade Level.

GRADE	N	PRE-TEST MEAN (SD)	POST-TEST MEAN (SD)	EFFECT SIZE (*d*)
7	64	13.84 (3.49)	16.98 (3.05)	1.31
8	66	15.52 (3.42)	18.68 (3.54)	1.39
9	79	16.27 (3.34)	19.22 (2.33)	1.31
10	88	11.91 (2.94)	13.53 (3.90)	0.50
11	165	16.14 (4.69)	18.71 (4.62)	0.80
12	262	16.77 (3.83)	18.87 (4.16)	0.57

p-value = < .001.

Grade 7 students (n = 64) had a mean pre-test score of 13.84 (SD = 3.49), which increased to 16.98 (SD = 3.05) in the post-test. A paired samples t-test revealed a statistically significant improvement, $t(63) = 10.46$, $p < .001$, with a mean difference of 3.14 (95% CI [2.54, 3.74]), and a large effect size ($d = 1.31$). Grade 8 students (n = 66) showed a mean increase from 15.52 (SD = 3.42) to 18.68 (SD = 3.54). This gain was also statistically significant, $t(65) = 11.26$, $p < .001$, with a mean difference of 3.17 (95% CI [2.61, 3.73]) and a large effect size ($d = 1.39$). Grade 9 students (n = 79) improved from a pre-test mean of 16.27 (SD = 3.34) to a post-test mean of 19.22 (SD = 2.33), a statistically significant change, $t(78) = 11.67$, $p < .001$, with a mean difference of 2.95 (95% CI [2.45, 3.45]) and a large effect size ($d = 1.31$). Grade 10 students (n = 88) increased their scores from 11.91 (SD = 2.94) to 13.53 (SD = 3.90), $t(87) = 4.68$, $p < .001$, with a mean difference of 1.63 (95% CI [0.93, 2.32]) and a moderate effect size ($d = 0.50$). Grade 11 students (n = 165) improved from 16.14 (SD = 4.69) to 18.71 (SD = 4.62), $t(164) = 10.25$, $p < .001$. The mean difference of 2.57 (95% CI [2.07, 3.06]) corresponded to a large effect size ($d = 0.80$). Grade 12 students (n = 262) increased from 16.77 (SD = 3.83) to 18.87 (SD = 4.16), $t(261) = 9.28$, $p < .001$, with a mean difference of 2.10 (95% CI [1.65, 2.54]) and a moderate effect size ($d = 0.57$).

These findings indicate statistically significant improvements in science learning outcomes following the integration of OERs, with effect sizes ranging from moderate to large. The paired samples design strengthened the internal validity, as each participant served as their own control.

PAIRED SAMPLE t-TEST RESULTS

The paired samples t-test revealed statistically significant improvements in science test scores across all grade levels (Grades 7–12) after students used Open Educational Resources (OERs). Grades 7, 8, and 9 showed large effect sizes (Cohen's d = 1.31–1.39) and mean score increases of around 3 points, indicating strong gains. Grade 10 had a smaller improvement (mean difference = 1.63) with a medium effect size (d = 0.498). Grades 11 and 12 also improved significantly, with moderate to large effect sizes (d = 0.798 and 0.57, respectively). These findings suggest that the OER intervention positively impacted students' academic performance in science, with particularly strong effects in the lower grade levels.

Analysis of students' perceptions across Grades 7 to 12 (Table 2) reveals a consistently positive response toward the use of Open Educational Resources (OERs) in science learning. The most substantial improvements were observed in students' enjoyment of learning through OERs, their preference for OERs over traditional textbooks, and their perceptions of improved retention and learning quality—many of which registered large to very large effect sizes. In particular, Items 1 ("I enjoy learning in an environment that incorporates OER"), 3 ("OERs helped me to improve my retention"), and 6 ("OER makes me feel more engaged") showed strong positive shifts across all grade levels, with Grades 8 and 9 reporting effect sizes close to or exactly at 1.00, indicating a very large impact.

SURVEY STATEMENT	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12
1. I enjoy learning in an environment that incorporates OER	0.77	1.00	0.95	0.91	0.91	0.81
2. I would describe using OERs as interesting resources	0.48	0.97	0.98	0.81	0.91	0.87
3. OERs helped me to improve my retention for this course	1.00	1.00	0.28	0.97	0.98	0.93
4. I can intelligently critique the OER used in this course	1.00	1.00	0.92	0.95	0.92	0.86
5. OERs offer advantages in my course	0.41	0.88	0.97	0.92	0.94	0.90
6. OER makes me feel more engaged with my learning	1.00	1.00	0.98	0.78	0.81	0.53
7. Prefer to use OER over traditional textbooks	1.00	1.00	0.97	0.79	0.73	0.62
8. OER directly improves the quality of my learning	0.84	1.00	0.96	0.84	0.83	0.70
9. OER matches textbook content	1.00	1.00	0.96	0.74	0.72	0.62
10. OER helps me understand topics better than textbooks	0.20	1.00	0.83	0.76	0.94	0.76
11. OERs contribute to a better understanding of this course	–	1.00	0.95	0.77	0.76	0.69
12. OERs are easy to use	–	0.68	0.88	0.86	0.88	0.81
13. OERs are convenient for learning and studying	–	1.00	0.84	0.63	0.57	0.37
14. I can easily adapt to using the OERs	–	1.00	0.68	0.84	0.84	0.83

Table 2 Wilcoxon Signed-Rank Test Results – Grade 7–12 Students' Perceptions of OER.

Notes: A dash (–) means the item was not statistically significant for that grade level or data was not reported.

Effect sizes: 0.2–0.49 = Small; 0.5–0.79 = Medium; 0.8+ = Large; 1.0 = Very large.

Furthermore, perceptions related to the quality and usability of OERs (Items 4, 5, 8, and 12) also yielded large effect sizes, suggesting that students found the materials not only engaging but also advantageous and easy to use. The ability to critique OERs (Item 4) and the perceived alignment between OER and textbook content (Item 9) were especially notable in Grades 8 to 11. Interestingly, while the lower grade levels (Grades 7 to 9) tended to report the highest effect sizes across most items, the responses from Grades 10 to 12 remained strongly positive but with slightly reduced magnitudes, particularly in areas such as convenience (Item 13) and preference over textbooks (Item 7).

Overall, these findings indicate that the OER experience significantly enhanced students' perceptions of science learning across all grade levels. The widespread large effect sizes suggest that OERs contributed not only to greater engagement and enjoyment but also to improved perceived learning outcomes and usability. This underscores the value of integrating OERs into secondary education, particularly as a flexible and student-friendly resource in science instruction.

DISCUSSION

Findings demonstrate that OER integration in HyFlex science instruction improves both academic performance and perceptions. The particularly strong effects in Grade 7-9 align with constructivist principles, suggesting younger learners benefit more from interactive, adaptive tools. Tapering effects in senior high may relate to cognitive load, established study habits, or prior reliance on textbooks. The analysis of pre- and post-test scores revealed statistically significant gains across all grade levels (Grades 7 to 12), suggesting that OERs can be an effective pedagogical tool in enhancing conceptual understanding in science education, even within the constraints of limited face-to-face interaction. This study adds to OER-HyFlex scholarship by contextualizing findings in Philippine secondary education. Compared with international studies (see Mishra, 2025; Tseng et al., 2024; Klar, 2024), our findings reinforce the value of OER for equity and engagement.

The large effect sizes observed in Grades 7, 8, and 9 (Cohen's d = 1.31–1.39) underscore the particularly strong impact of OER use among lower secondary students. These findings echo previous studies that have documented how digital and open-access instructional resources can foster deeper learning when integrated into thoughtfully designed instructional models (Hilton, 2016; Weller et al., 2020). In contrast, while Grade 10, 11, and 12 students also exhibited significant improvement, the effect sizes were moderate to large (d = 0.50–0.80), possibly reflecting more stable or plateauing academic performance among older students or differing levels of digital receptiveness and cognitive load (Bodily, Nyland, & Wiley, 2017). Nonetheless, the consistent gains across all groups affirm the value of OERs in promoting academic success across diverse age and grade levels.

Student perception data further supports the effectiveness of OER implementation. The Wilcoxon Signed-Rank Test analysis of survey responses revealed overwhelmingly positive shifts in attitudes toward OER-based instruction. Across all grade levels, students reported higher enjoyment, increased engagement, and improved perceived learning quality after exposure to OERs. Effect sizes for key survey items—such as enjoyment (Item 1), improved retention (Item 3), and perceived quality of learning (Item 8)—ranged from large to very large, with several reaching or exceeding 1.00. These findings are aligned with prior research that highlights how OERs enhance learner motivation, agency, and satisfaction, especially when they are well-aligned with curriculum standards and learner needs (Bliss et al., 2013a; de los Arcos et al., 2016).

Interestingly, while Grades 7 to 9 consistently reported the highest effect sizes in both academic performance and perception-related indicators, a gradual tapering was observed in Grades 10 to 12. This pattern may be attributed to developmental differences in cognitive maturity, study habits, or previous exposure to traditional textbook-based learning, which may influence how senior high school students perceive and adapt to new digital instructional tools (Pitt et al., 2020). Nevertheless, even in these upper grades, students showed strong agreement with positive statements about OERs' accessibility, usability, and relevance, suggesting a broad applicability of OERs across different educational stages.

Another key insight from the perception data is the high rating for OER alignment with textbook content (Item 9), and the ease of use and adaptability of the resources (Items 12 and 14), which reflect the careful selection and design of OER materials used in the study. These attributes are vital for student-centered learning environments and reinforce the argument that high-quality OERs can match, if not exceed, traditional educational resources in supporting effective science instruction (Hilton, 2016).

Taken together, the study's findings offer robust support for the integration of OERs in basic education science curricula, particularly within flexible learning modalities such as Hyflex. Not only do OERs provide measurable academic benefits, but they also promote positive learner experiences by enhancing engagement, confidence, and access to relevant content. This is especially significant in post-pandemic educational contexts where equitable, inclusive, and adaptable learning tools are increasingly necessary (Bozkurt et al., 2020). Moving forward, further research could explore long-term retention, performance in higher-order thinking skills, and how teacher facilitation influences OER efficacy in blended learning settings.

CONCLUSION

This study showed that OERs, when integrated into HyFlex science instruction, siginificantly improve student learning outcomes and perceptions across Grades 7 to 12. Quantitative findings from pre- and post-tests revealed statistically significant improvements in students' science scores, with effect sizes ranging from moderate to large. These results indicate that OERs are not only pedagogically effective but also adaptable to diverse learner profiles and grade levels.

Moreover, the perception data gathered through surveys showed overwhelmingly positive responses toward OER use, particularly in terms of enjoyment, engagement, content alignment, and usability. The strongest effects were noted among students in lower grade levels (Grades 7 to 9), suggesting that younger learners may benefit most from interactive and flexible digital content. Nonetheless, the findings affirm that OERs remain impactful across all secondary grade levels.

While these findings affirm the promise of OERs, the study has several limitations, First, it was conducted in a single institution, which may restrict generizability. Second, the absence of a control group limits causal claims. Third, the intervention was aligned only with the Department of Education's Most Essential Learning Competencies (MELCs), which may not fully represent the broader science curriculum. Finally, the study covered only one academic quarter, making long-term retention effects unclear.

Future research should address these limitations by conducting multi-site comparative studies across varied contexts, employing experimental or mixed-method designs with control groups, and examining long-term impacts on retention and higher-order thinking skills. Investigating the role of teacher facilitation, student digital readiness, and integration of OERs across other subjects would also provide valuable insights. Cross-national studies may further illuminate how OER-HyFlex models operate in different resource-constrained and disrupted learning environments.

Overall, the study underscores the potential of OERs to transform science instruction by fostering meaningful learning experiences, promoting accessibility, and supporting differentiated instruction within flexible delivery modalities. As educational systems continue to adapt to blended and digital approaches, this research contributes to the growing body of evidence supporting OER implementation in basic education, particularly in resource-constrained or disrupted learning environments.

DATA ACCESSIBILITY STATEMENT

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

SUSTAINABLE DEVELOPMENT GOALS (SDGs)

This study is linked to the following SDG(s): Quality education (SDG 4).

ETHICS AND CONSENT

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS (CRediT)

Eric Awi: Methodology, data analysis, draft preparation, writing of discussion, results, and conclusion, review and editing. All authors have read and agreed to the published version of the manuscript. Audrey Joyce Valderrama: Conceptualization, writing of introduction, statistical analysis, data gathering. All authors have read and agreed to the published version of the manuscript. Geraldine Lagmay: Data gathering, writing of introduction and literature review, editing and review of the manuscript, finalizing reference list. All authors have read and agreed to the published version of the manuscript.

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REFERENCES

Aboagye, E., Yawson, J. A., & **Appiah, K. N.** (2020). COVID-19 and e-Learning: The challenges of students in tertiary institutions. *Social Education Research, 1*(1), 109–115. https://doi.org/10.37256/ser.122020422

Alvarez, A. V. (2020). The phenomenon of learning at a distance through emergency remote teaching amidst the pandemic crisis. *Asian Journal of Distance Education, 15*(1), 144–153. https://doi.org/10.5281/zenodo.3881529

Angeli, C., & **Valanides, N.** (2005). Preservice elementary teachers as information and communication technology designers: An instructional systems design model based on an expanded view of pedagogical content knowledge. *Journal of Computer Assisted Learning, 21*(4), 292–302. https://doi.org/10.1111/j.1365-2729.2005.00135.x

Appana, S. (2008). A Review of Benefits and Limitations of Online Learning in the Context of the Student, the Instructor and the Tenured Faculty. *International Journal on E-Learning, 7*(1), 5–22. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE). Retrieved July 1, 2025 from https://www.learntechlib.org/primary/p/22909/.

Barr, R., & **Luo, T.** (2025). HyFlex course design: Outcomes, challenges, and supports—A systematic review of empirical studies. *Journal of Computing in Higher Education*, *37*(1), 45–68. https://doi.org/10.1007/s12528-025-09452-6

Beatty, B. J. (2006, March). Designing the HyFlex world: Hybrid, flexible classes for all students. *Proceedings of the 11th Annual Conference on Technology in Collegiate Mathematics* (pp. 1–6). Orlando, FL: Addison-Wesley.

Bialo, E. R., & **Sivin-Kachala, J.** (1996). The effectiveness of technology in schools: A summary of recent research. *School Library Media Quarterly*, *25*(1).

Bliss, T. J., Hilton, J., Wiley, D., & **Thanos, K.** (2013a). The cost and quality of open textbooks: Perceptions of community college faculty and students. *First Monday*, *18*(1). https://doi.org/10.5210/fm.v18i1.3972

Bliss, T. J., Robinson, T. J., Hilton, J., III, & **Wiley, D. A.** (2013b). An OER COUP: College teacher and student perceptions of open educational resources. *Journal of Interactive Media in Education, 2013*(1), Article 4. https://doi.org/10.5334/2013-04

Bodily, R., Nyland, R., & **Wiley, D.** (2017). The RISE Framework: Using learning analytics to automatically identify open educational resources for continuous improvement. *International Review of Research in Open and Distributed Learning, 18*(2), 103–122. https://doi.org/10.19173/irrodl.v18i2.2952

Bozkurt, A. (2023). From individual testimonials to collective voices: Openness in education as a praxis. *Open Praxis*, *15*(2), 97–110. https://doi.org/10.55982/openpraxis.15.2.574

Bozkurt, A., Jung, I., Xiao, J., Vladlena, B., & **Zawacki-Richter, O.** (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education, 15*(1), 1–126. https://doi.org/10.5281/zenodo.3878572

Castillo, J. (2020). *Distance learning? Don't Take Power Availability for Granted*. Retrieved from https://mb.com.ph/2020/09/25/distance-learning-dont-take-power-availability-for-granted

Cotton, K. (1991). *Teaching thinking skills*. Northwest Regional Educational Laboratory, School Improvement Research Series, Close-Up #11. https://educationnorthwest.org/sites/default/files/TeachingThinkingSkills.pdf

de los Arcos, B., Farrow, R., Pitt, R., Weller, M., & **McAndrew, P.** (2016). Adapting the curriculum: How K-12 teachers perceive the role of open educational resources. *Journal of Online Learning Research and Practice, 2*(1), 23–40. Retrieved from https://eric.ed.gov/?id=EJ1148381

Dhanarajan, G., & **Porter, D.** (Eds.). (2013). *Open educational resources: An Asian perspective*. Commonwealth of Learning & OER Asia. https://www.oerknowledgecloud.org/archive/pub_PS_OER_Asia_web.pdf

Farrow, R. (2024). Understanding innovation vectors in the use of OER. *Open Praxis*, *16*(4), 480–493. https://doi.org/10.55982/openpraxis.16.4.702

Hilton, J. (2016). Open educational resources and college textbook choices: A review of research on efficacy and perceptions. *Educational Technology Research and Development, 64*, 573–590. https://doi.org/10.1007/s11423-016-9434-9

JISC. (2013). Open educational resources (OER) programme: Phase three (2009–2012). Joint Information Systems Committee. Retrieved from https://www.jisc.ac.uk/full-guide/open-educational-resources

Johnstone, S. M. (2005). Open educational resources serve the world. *EDUCAUSE Quarterly, 28*(3), 15. https://er.educause.edu/articles/2005/6/open-educational-resources-serve-the-world

Karunanayaka, S. P., Naidu, S., Rajendra, J. C. N., & **Ratnayake, H. U. W.** (2016). Designing reflective practice in the context of OER-based e-learning. *8th Pan-Commonwealth Forum on Open Learning (PCF8)*, Kuala Lumpur, Malaysia. https://doi.org/10.56059/jl4d.v4i2.210

Klar, M. (2024). OER in K–12: Enablers and barriers in German schools. *Open Praxis*, *16*(3), 241–254. https://doi.org/10.55982/openpraxis.16.3.679

Mateo, J. (2020, August 2). Tech woes among top concerns for distance learning. Retrieved from The Philippine Star: https://www.philstar.com/headlines/2020/08/02/2032336/tech-woes-among-topconcerns-distance-learning

Means, B., Ruskus, J., & **Olson, K.** (1995). *Technology and education reform: Technical research report*. U.S. Department of Education, Office of Educational Research and Improvement. Retrieved from https://eric.ed.gov/?id=ED397561

Mishra, S. (2025). A review of reviews on open educational resources. *Open Praxis*, *17*(2), 123–136. https://doi.org/10.55982/openpraxis.17.2.851

Neo, M., Neo, T. K., & **Yap, W. L.** (2013). Students' perceptions of interactive multimedia mediated web-based learning: A Malaysian perspective. *Proceedings of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE)*, 658–666. https://doi.org/10.14742/apubs.2008.2399

Örnek, F., Robinson, W. R., & **Haugan, M. P.** (2008). What makes physics difficult? *International Journal of Environmental & Science Education, 30*(1), 30–34. Retrieved from https://eric.ed.gov/?id=EJ894842

Panday-Shukla, A. (2024). Comparing an open educational resource to a traditional textbook: Task engagement and quality perceptions. *Foreign Language Annals*, *57*(2), 211–229. https://doi.org/10.1111/flan.12727

Piaget, J. (1970). *Science of education and the psychology of the child.* Viking Press.

Pitt, R., Jordan, K., de los Arcos, B., Farrow, R., & **Weller, M.** (2020). Supporting open educational practices through open textbooks. *Distance Education, 41*(2), 303–318. https://doi.org/10.1080/01587919.2020.1757411

R Core Team. (2024). *R: A language and environment for statistical computing (Version 4.4.0)* [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/

Science Education Institute and University of the Philippines-National Institute for Science and Mathematics Education (SEI-DOST & UP NISMED) (2011). *Science Framework for Philippine Basic Education*. SEI-DOST & UP NISMED. Retrieved from http://www.sei.dost.gov.ph

Sheingold, K., & **Hadley, M.** (1990). *Accomplished teachers: Integrating computers into classroom practice*. Center for Technology in Education, Bank Street College of Education. Retrieved from https://eric.ed.gov/?id=ED322900

Tseng, H., Chen, Y., & **Lin, J.** (2024). Exploring students' creative mindset, perceived values of OER, and flow: An exploratory study. *Open Praxis*, *16*(4), 377–391. https://doi.org/10.55982/openpraxis.16.4.747

UNESCO. (2009). *Open educational resources: Conversations in cyberspace*. United Nations Educational, Scientific and Cultural Organization. https://unesdoc.unesco.org/ark:/48223/pf0000181682

Varma, S. G. (2023). An initiative to develop OER-based general education (GED) courses. *Open Praxis*, *15*(2), 111–122. https://doi.org/10.55982/openpraxis.15.2.520

Von-Rhöneck, C., Grob, K., Schnaitmann, G. W., & **Völker, B.** (2007). Learning in basic electricity: How do motivation, cognitive, and classroom climate factors influence achievement in physics? *International Journal of Science Education, 20*(5), 551–565. https://doi.org/10.1080/0950069980200504

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Weller, M., Jordan, K., DeVries, I., & **Rolfe, V.** (2020). Mapping the open education landscape: Citation network analysis of historical open and distance literature. *Open Praxis, 12*(3), 283–299. https://doi.org/10.5944/openpraxis.10.2.822

Wiley, D. (2014). *The access compromise and the 5th R.* Iterating Toward Openness. Retrieved from https://opencontent.org/blog/archives/3221

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