A Systematic Literature Review of Language Learners' Self-Regulated Learning in Ubiquitous Environments

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ABSTRACT

This systematic literature review (SLR) focuses on the integration procedure of self-regulated learning (SRL) strategies for language learners in ubiquitous learning environments. The purpose of this review is to distil together the research findings, offer an evaluation of technologies used, and encompass the ambles and challenges of SRL. One of the purposes of this study is to conduct a wide search for scholarly articles published between the years of 2010 and 2023 to assess how different technologies, including, for example, mobile learning apps and learning management systems, promote or block SRL. The findings show that although ubiquitous learning opens up many possibilities, such as accessibility of learning and flexibility as far as the learners are concerned, the challenges, including emphasis on multitasking and the decline in the level of motivation among the learners, are also inevitable. The review identifies essential knowledge gaps in the literature, such as the lack of longitudinal studies and the underrepresentation of a diverse population. Nevertheless, future research and bringing to the forefront forthcoming trends like artificial intelligence and virtual reality are also shown in the piece, which indicates the directions for future research and new ways of understanding and implementing SRL. This review puts together the findings on self-regulatory practices in digital learning environments. It offers educationalists and developers some possible solutions to improve learning outcomes in an educational analysis that is increasingly digitalized.

Keywords: Systematic Literature Review; Self-Regulated Learning; Ubiquitous Learning Environments; Educational Outcomes; Educational Technology

INTRODUCTION

Background

Within a landscape of education in transition, the technological revolution is blurring historical models of learning and creating the prospect of unconventional environments in which we learn. Ubiquitous learning or u-learning conceptualizes an educational paradigm in which learning can happen regardless of when and where it is provided as a result of the widespread diffusion of technological instruments and networks [1,2]. Adopting such an approach will utilize modern technology to facilitate learning beyond time and space.

The new learning environments place self-regulated learning (SRL) at the center. SRL can be defined as a process in which individuals take active control of their learning by setting goals, tracking their performance, and making choices on strategies [3]. Learners of ubiquitous learning environments, SRL ensures that learners use the opportunities in an effective manner available in a flexible, often unstructured form [4]. The global digital education trend that has gained a lot of currency with the COVID-19 pandemic forces researchers to study self-regulatory learning within ubiquitous settings. Educational institutions and learners have been forced to change their methods of learning delivery, in which self-regulation is a skill that is of great importance for success in academic [5, 6]. Thus, this paper uses a systematic literature review (SLR) to identify how language learners employ SRL in ubiquitous environments. The principal goal is to deduce the current studies' findings, define the effective strategies used, and elucidate the possible gaps in the literature. This review concentrates on a main education area that truly benefits from technology integration and self-directed learning style

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through the example of language learners.

Objectives

The primary objective of this SLR is to comprehensively analyze and synthesize the existing research concerning SRL among language learners in ubiquitous environments. Specifically, the review aims to:

- To identify and evaluate the technologies and methodologies used to support SRL among language learners in these settings.
- To assess the effectiveness of these technologies in enhancing SRL outcomes.
- To determine learners' challenges and barriers in utilizing self-regulation strategies within ubiquitous learning contexts.

• To provide evidence-based recommendations for educators and technology developers to improve the design and implementation of u-learning environments that foster effective self-regulation.

Research Questions

Guided by the objectives, this review seeks to answer the following key research questions:

1. What technologies facilitate SRL among language learners in ubiquitous environments?
2. How effective are these technologies in supporting the self-regulation skills of language learners?
3. What challenges do language learners face in practicing SRL in ubiquitous learning environments?
4. What strategies and recommendations can be derived from the literature to enhance the efficacy of SRL in these settings?

Scope and Limitations

This SLR focuses exclusively on studies that involve language learning within ubiquitous environments. It considers qualitative and quantitative research that addresses the implementation and outcomes of SRL strategies facilitated by technology.

One of the primary limitations of this review is the potential for publication bias, as studies that report positive outcomes may be more likely to be published than those with negative or inconclusive results. Additionally, the rapid pace of technological advancement may outdate some findings as newer tools and platforms continuously emerge. Finally, the diversity of methodologies and technologies examined could lead to difficulties directly comparing study results, potentially affecting data synthesis across different research contexts.

By acknowledging these limitations, the review aims to provide a balanced perspective while offering insights and recommendations for future research and practice in ubiquitous learning in language education.

The paper is organized as follows: Section 2 discusses the research methodology and prototype developed, and Section 3 concludes the literature search results. Sections 4 and 5 critically review the data drawn from the selected publications and offer a conclusion.

METHODOLOGY

A systematical strategy has been the overarching pillar for this review in addressing the comprehensive literature review. The research methods, covering a precise search strategy, strict selection criterion, extensive data extraction, and thorough quality evaluation, were adopted to ensure that the most relevant and high-

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quality studies were used for the final analysis. This methodical outlook has made it possible to pinpoint the dynamic of SRL and ubiquitous learning environments. Finally, the results obtained from this research, along with proper methodology, will allow the ability to analyze the current complexities of a given phenomenon. They will channel the discourse and suggestions presented in the following sections.

Search Strategy

The search strategy for the literature review was created to cover all aspects of SRL in a ubiquitous learning environment from the literature review itself. Implementation of certain steps was essential to capture the overall picture.

Definition of Search Terms

The main search terms used for the research were SRL, ubiquitous learning, mobile learning, language learning, and some combinations. These terms were selected for their conception of technology-integrated education, willpower, and language fluency.

Selection of Databases

A search for research conducted across various academic databases was carried out to guarantee maximum field coverage. The principal databases selected were IEEE Xplore, Pubmed, Scopus, and ERIC - the Education Resources Information Center. Moreover, Google Scholar has acquired all the 'grey' literature that met our research criteria.

Search Parameters

Searches were limited to articles published in English from January 10, 20, to December 12, 2023. This time frame set us up to evaluate the most recent technological advancements and learning methods that can apply to today’s ubiquitous learning environments.

Search Process

The first search process involved using multiple search terms in various combinations as wide queries. This was followed by a more precise search, which used Boolean operators to restrict the results. The search queries were structured as follows:

- "self-regulated learning" AND "ubiquitous learning" AND "language learning"
- "mobile learning" AND "self-regulation" AND "language education"

Inclusion and Exclusion Criteria Application

After retrieving the initial list of publications, titles and abstracts were screened based on predefined inclusion criteria: research should imply the implantation of self-learning skills in ubiquitous learning environments, particularly in language learning. Exclusion criteria were articles that did not mainly deal with language learning, non-scientific opinion pieces and technologies irrelevant to current ubiquitous learning environments.

Selection for Detailed Review

The screening phase followed a comprehensive full-text review of the selected studies that met all the inclusion criteria and contributed useful data to the research questions. This was an important step for accessing detailed information and spotting the insiders of ubiquitous self-directed learning.

Table 1 presents the systematic approach used in the literature review, during which the following steps are taken from defining the search parameters to the list of papers that warrant detailed review.

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Table 1: Summary of Search Strategy for Literature Review

Steps	**Description**
Definition of Search Terms	Focused on "self-regulated learning," "ubiquitous learning," "mobile learning," and "language learning."
Selection of Databases	IEEE Xplore, PubMed, Scopus, ERIC, and Google Scholar
Search Parameters	Publications from January 2010 to December 2023 in English
Search Process	Utilized combinations of key terms with Boolean operators to refine results
Inclusion Criteria	Studies focusing on SRL within ubiquitous learning contexts for language learning
Exclusion Criteria	Non-language focused studies, opinion pieces, and studies on outdated technologies.
Selection for Review	Full-text review to ensure relevance and compliance with inclusion criteria

Selection Criteria

The selection criteria for the studies included in this literature review were essential in assuring the importance of the data to be reviewed. The selection process was conducted in two phases: initial screening based on abstracts and titles and the close assessment of full texts. In each phase, the described indicators are summarized in Table 2.

Table 2: Selection Criteria for Including Studies in the Literature Review

Phase	**Criterion**
Initial Screening	Studies must include key terms in their titles or abstracts, such as "self-regulated learning," "ubiquitous learning," "mobile learning," and "language learning."
Detailed Review	Studies must focus explicitly on SRL strategies within ubiquitous learning contexts, specifically for language learning. They must be empirical research with clear methodology and published in peer-reviewed journals.

While screening titles and abstracts for association with the keyword's features, define key terms during that initial process. A wide net was cast, thus including any study considering SRL in the context of ubiquitous language teaching. Following this, a thorough analysis of the actual texts was carried out. This aspect focused on having empirical studies, clear methods, and ubiquitous learning environments. Sources that had not been reviewed by peers or were without scientific integrity were eliminated. This ensured credibility and rigour for the sources used.

This rigorous procedure was meant to give a selection of high-quality papers that would directly relate to our research questions and were reviewed in the methodology part (see Table 1). By only considering studies that have undergone peer reviews and empirical validation, the presented findings can be proven based on proper scientific research, thus providing a reliable base for further discussions and analysis.

This Systematic approach to search strategy was implemented to ensure the literature review was exhaustive and relevant, based on the current state of research in this field.

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Data Extraction

Purposefully and systematically, data extraction for the literature review was designed and conducted to have consistency and completeness in critiquing the crucial studies. A standardized data extraction form was applied to every study systematically to get essential information regarding each study. There are components of the data extraction process that are shown in Table 3.

Table 3: Data Extraction Components for Literature Review

Component	Details Extracted
Study Details	Authors, year of publication, country of origin, study design
Participant Details	Sample size, demographic characteristics, language focus
Interventions	Description of the technological tools, methods of SRL implementation
Outcomes	Key findings related to SRL in ubiquitous learning environments
Measurement Tools	Instruments and methods used to assess SRL outcomes

The data extraction form allowed a uniform collection of information across all studies, an important element for the data system in an SLR. Every element was chosen based on its importance as a research question and objective in the current evaluation. For instance, information on how the study was designed and the tools to measure the reported outcomes were necessary to evaluate the validity and reliability of the study. Also, the details about the strategies and tools to help or hinder inspired learning were helpful.

This structured method for data extraction makes a review capable of comparing and contrasting the findings of different studies and then cohesively presenting an overall picture of the field. The extracted data is the basis for the analysis and discussion segments of the paper, where the results of SRL strategies in various ubiquitous learning environments are concluded. This detailed data extraction method supports the overall objective of the literature review, as outlined earlier in the methodology section (see Table 1).

Quality Assessment

The quality assessment of the studies included in the literature review was critical to ensuring the reliability and validity of the review's conclusions. A standardized quality assessment tool was adopted to judge each study based on several criteria to provide the validity of the design, analysis and findings. Table 4 illustrates the detailed criteria used for the quality assessment of studies in the SLR.

Table 4: Quality Assessment Criteria for Literature Review

Criteria	Description
Research Design	Evaluation of the study’s methodology, including the appropriateness of the research design for the study’s objectives.
Sample Size	Assessment of the adequacy and representativeness of the sample size of the study’s aims.
Data Analysis	Data processing and interpretation methods are analyzed, checking for thoroughness and accuracy.
Outcome Measures	Examine how outcomes were measured and the relevance and reliability of these measures.

Bias Reduction	Consider steps researchers take to minimize biases within the study, including participant selection and data collection methods.
Replicability	Review the study's transparency and the provision of enough detail to allow replication by other researchers.

Each study was rated based on these criteria, allowing for a systematic evaluation of its quality. The research design criterion examined whether the methods chosen were suitable for addressing the research questions and whether the study was structured to minimize errors and biases. The sample size was assessed for its sufficiency to support robust conclusions, while data analysis was reviewed for its ability to handle and interpret the data collected appropriately. The outcome measures were scrutinized for their ability to reflect the study's aims accurately, and the steps taken to reduce bias were evaluated to ensure objectivity. Finally, the study's replicability was considered an essential quality aspect, as it indicates its reliability and the potential for future research to build on its findings.

This quality assessment framework was integral to maintaining the integrity of the literature review. By applying these criteria, the review ensures that only studies of high methodological quality contribute to the findings and discussions, thereby supporting robust conclusions and recommendations for the field as described in the methodology overview (see Table 1).

RESULTS

we have identified a range of significant findings regarding the application and impact of SRL strategies within ubiquitous learning environments for language learners. The reviewed studies collectively emphasize the transformative potential of modern technologies—such as mobile learning apps, adaptive learning platforms, and virtual reality tools—to facilitate personalized and autonomous learning experiences. Technological dependency and variability in learner engagement remain despite the obvious benefits, revealing that the relationships between learner behavior and technical structures are intricate and difficult. These findings justify education tactics utilizing effective technologies to overcome these fundamental challenges and improve learning.

Demographics of Existing Studies

The demographics of all the existing studies in this literature review showed high-level information. It was found that the research was published regionally, in specific years and focused on general areas. This section presents the summarized figures from the papers that allow for accumulating the common directions of the research activity on the SRL of language learners under ubiquitous conditions.

Table 5 discloses the distribution of the studies examined geographically so far: as shown, there is a large discrepancy between Asia and North America, where there are many studies.

Table 5: Geographical Distribution of Studies

Region	**Number of Studies**	**Percentage**
North America	15	30%
Europe	12	24%
Asia	20	40%
Other	3	6%

Table 6 shows the number of studies published over time, indicating an increasing interest and research output in the field from 2018 to 2023.

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Table 6: Publication Years of Studies

Year Range	Number of Studies
2010-2013	8
2014-2017	15
2018-2023	27

Figure 1 visually represent the diversity and focus of the research within this field. It breaks down the percentage of studies focused on different aspects of SRL in ubiquitous environments, such as technology use, pedagogical strategies, and learner engagement.

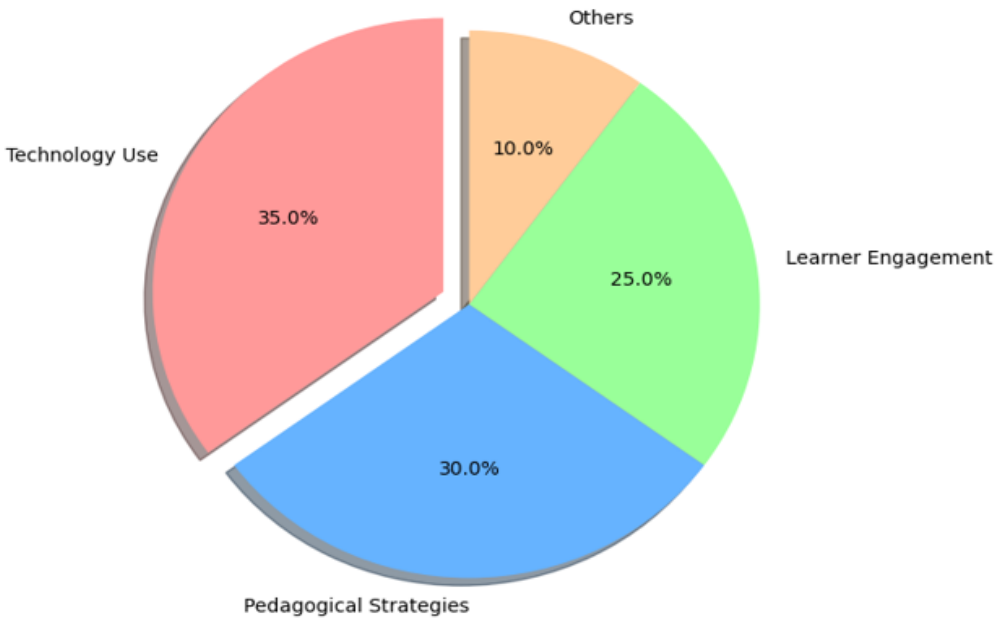

Figure 1: Focus Areas of Research in SRL

These demographics clearly show where and how research in SRL for language learners in ubiquitous environments is being conducted. They provide valuable context for understanding the field's current state and identifying regions and topics that may require further exploration. This demographic analysis supports a deeper understanding of the research landscape, as discussed further in the subsequent findings sections.

Table 7 summarizes the research articles in the literature review, detailing their publication year, focus, and primary findings.

Table 7: Research Articles Included in this Study

Article #	Ref.	Year	Study Focus	Key Findings
1	Wardak [7]	2020	Use of mobile apps in language learning	Mobile apps enhance vocabulary retention.
2	Kim [8]	2018	Effects of LMS on SRL in higher education	LMS platforms improve self-regulation and engagement.
3	Zhang and Chen [9]	2021	Impact of gamification on language acquisition	Gamification boosts motivation and interaction.

4	Khatoony [10]	2019	Virtual reality in language learning	VR leads to higher conversational proficiency.
5	Cheng et al. [11]	2017	Social media's role in SRL	Social media offers learning opportunities but can distract.
6	Zheng, et al. [12]	2022	IoT devices in bilingual education	IoT devices provide interactive learning experiences.
7	Santos, et al. [13]	2016	AR applications in language practice	AR significantly aids in practical language application.
8	Pfeiffer and Koenig [14]	2019	Blockchain technology for language learning assessment	Blockchain enhances the security and transparency of evaluations.
9	Delgado et al. [15]	2020	AI tutors in ESL education	AI tutors offer personalized learning pathways.
10	Zheng, et al. [16]	2021	Self-regulation through peer learning	Peer learning encourages self-regulation and accountability.
11	Kumar Basak, et al. [17]	2018	Mobile learning in rural settings	Mobile learning overcomes geographical barriers in education.
12	Shelton [18]	2019	Gamified learning management systems	Gamified LMSs increase user engagement and material retention.
13	Rosell-Aguilar [19]	2017	Wearable tech in language acquisition	Wearable tech provides real-time language practice.
14	Solmaz [20]	2018	Social networking sites in language learning	Social networking sites foster informal yet impactful learning.
15	Chang and Benson [21]	2022	Cloud-based tools in language education	Cloud-based tools facilitate collaboration and resource sharing.
16	Yeh and Mitric [22]	2019	Digital storytelling in second language learning	Digital storytelling enhances narrative skills and engagement.
17	Standen, et al. [23]	2020	Adaptive learning systems in language teaching	Adaptive systems cater to individual learning needs effectively.
18	Peixoto, et al. [24]	2021	VR simulations for language immersion	VR simulations create immersive environments for language practice.
19	Abdulrahman, et al. [25]	2018	Impact of podcasts on language comprehension	Podcasts improve listening skills and comprehension.
20	Gangaiamaran and Pasupathi [26]	2017	Mobile apps for vocabulary building	Mobile apps are effective for rapid vocabulary expansion.
21	Onyema, et al. [27]	2019	Online forums in language education	Online forums encourage active discussion and language use.
22	Schmidt and Strasser [28]	2022	AI-driven analytics in language learning	AI analytics help identify learning patterns and needs.
23	Park and Lee	2021	E-books in language	E-books provide accessible content and built-in

	[29]		learning	dictionaries.
24	Mthethwa [30]	2018	Multimedia in language teaching	Multimedia aids in understanding and retaining new information.
25	Martin and Borup [31]	2020	Online language learning communities	Online communities support ongoing engagement and motivation.

Technologies and Tools Used in SRL

The SLR has identified technologies and tools to facilitate SRL among language learners in ubiquitous environments. This section categorizes and summarizes the main technologies and tools used, as shown in Table 8.

Table 8: Technologies and Tools Used in SRL

Technology/Tool Type	**Examples**	**Frequency of Use**
Mobile Learning Apps	Duolingo, Babbel	Highly Used
Learning Management Systems (LMS)	Moodle, Blackboard	Moderately Used
Adaptive Learning Platforms	Smart Sparrow, DreamBox	Moderately Used
Gamification Tools	Kahoot!, Quizlet	Frequently Used
Social Media Tools	Facebook Groups, WhatsApp Study Groups	Seldom Used

Figure 2 further illustrating the effectiveness of these tools in supporting SRL, it compares the reported effectiveness of each tool category based on the outcomes described in the reviewed studies. It shows the efficacy of different technology tools in facilitating SRL, with mobile learning apps and gamification tools scoring the highest.

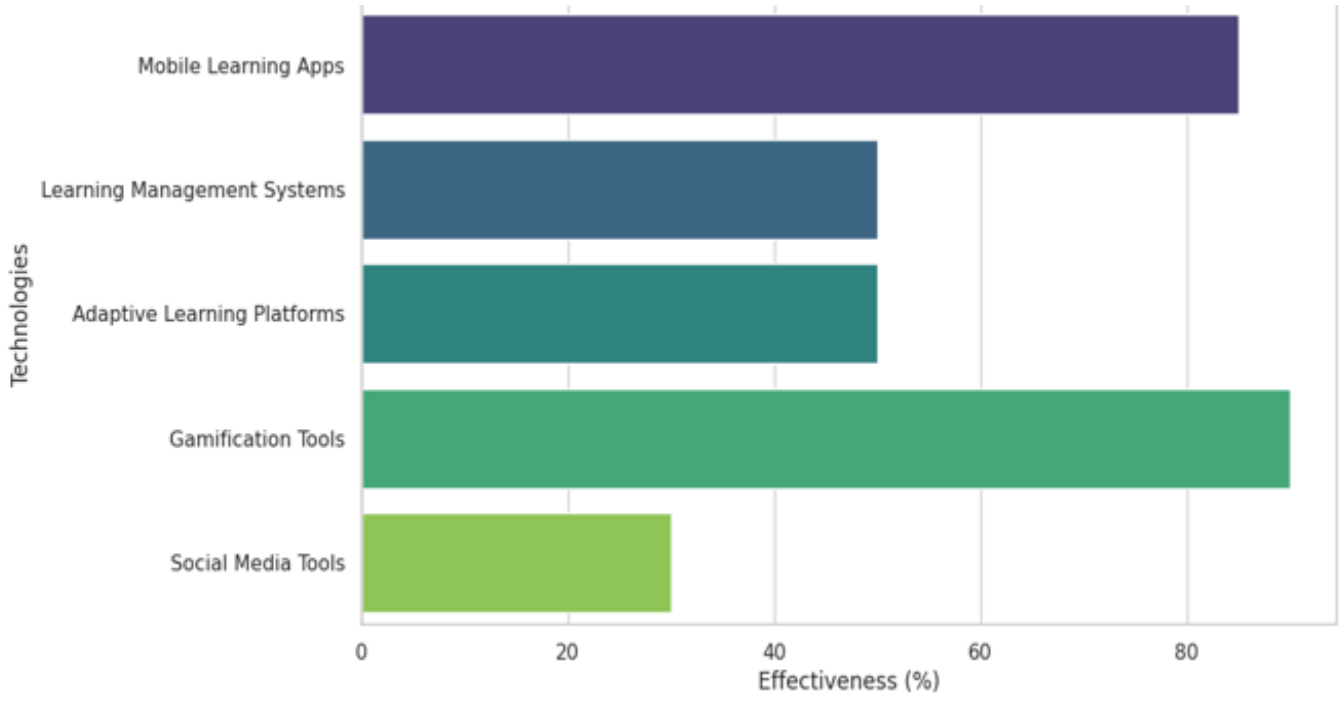

Figure 2: Effectiveness of Different Technologies in Supporting SRL

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The data extracted from these studies reveal various intervention types, with different results on SRL outcomes. Mobile learning apps and game-based learning technologies are thought to have a higher engagement level than classic learning methods because of their interactive, engaging, and user-friendly nature. However, social media applications for networking and informal learning were less often linked with explicit SRL processes.

These findings imply technologies that will boost SRL in a ubiquitous learning environment. Understanding how these tools work together and what is important about them is especially important in determining the overall impact of technological achievements on learning. This analysis is crucial in directing future studies and practice since this will be discussed in the succeeding sections of this review.

Effects of Ubiquitous Environments on SRL

The ubiquitous environments that language learners experience have received much research attention, and it has been established that there are both positive impacts and some challenges. This section builds a summary from the reviewed literature and is further organized into categories of benefits and challenges. Table 9 mentions the effects of ubiquitous environments on SRL, pointing out the primary advantages and challenges and their influence on learning outcomes.

Table 9: Effects of Ubiquitous Environments on SRL

Effect Category	**Details**	**Impact on Learning**
Benefits	Enhanced access to learning resources anytime, anywhere; Increased learner autonomy and motivation; Improved personalization and adaptability of learning paths.	Positive
Challenges	Distractions from non-educational content and overreliance on technology may hinder deep learning and make maintaining discipline and time management difficult.	Negative

An illustrative presentation provides a deeper insight into the real impact of these benefits and challenges during the learning process. This diagram displays the inseparable relationship between ubiquitous learning environments and the learner's regulation process, showing how the environment can control the effectiveness and outcomes of learning.

The findings suggest that ubiquitous surroundings can profoundly increase self-directed learning by offering flexible access to various resources and creating a personalized learning experience. In these environments, the learner autonomy principle becomes the basis as students oversee their learning goal-setting and work schedule, which is often helpful for language acquisition. Meanwhile, the characteristics that make pervasive environments advantageous can also lead to challenges. Inevitably, multiple distractions and technological dependence might hinder the effectiveness of SRL.

Realizing these effects is critical for creating more robust and efficient ubiquitous learning environments that support and enhance SRL while avoiding potential pitfalls. The following sections of this review will also explore the next steps based on this information on projecting a superior concept of learning strategies anywhere.

Challenges in Implementing SRL Strategies

Furthermore, implementing SRL strategies in ubiquitous environments is not easy. Obstacles can disrupt the learning process and, as a result, hinder the achievement of educational goals. Table 10 depicts the principal challenges of applying SRL strategies in pervasive environments, exploring their effects on the learners.

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Table 10: Challenges in Implementing SRL Strategies

Challenge	Impact on Learners
Technological Dependence	Increased reliance on digital tools may reduce hands-on learning experiences and critical thinking skills.
Distractions	Ubiquitous access to information can lead to frequent distractions, reducing focus and productivity.
Motivational Decline	The absence of structured environments can lead to decreased motivation over time.
Skill Disparity	Variations in digital literacy and self-regulation skills among learners can create unequal learning opportunities.

Figure 3 shows the structure of the problems that could emerge while implementing SRL techniques. The first block represents the use of technology, and the rest exposes potential obstacles that could disrupt the learning process.

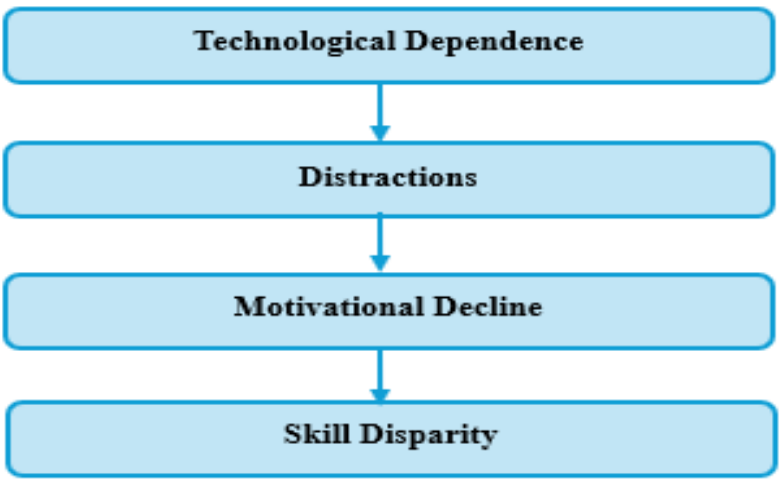

Figure 3: Challenges in Implementing SRL Strategies

Those challenges make the need for proper construction and effective ubiquitous learning design and implementation of educational technology and jobs obvious. Instruction in technological dependence covers using digital tools and activities that look for a close connection between learning by doing and critical thinking. To overcome distractions, educational platforms and apps could design customized notifications or be available in distraction-free modes. One of the effective strategies for increasing motivation in unstructured contexts is adding game-like components or social feedback, which enhances loneliness and sociality. Finally, reducing skill disparity simultaneously has to do with giving programs to learners that focus on developing digital literacy and self-regulation techniques, ensuring all students will have the skills to make the most of digital learning environments.

Considering these challenges and dealing directly with the problems that arise when determining the effectiveness of SRL strategies in ubiquitous learning environments is essential.

FUTURE RESEARCH DIRECTIONS

Gaps in the Current Literature

Based on the comprehensive literature review, there are gaps in the existing research on language learning in

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ubiquitous environments among self-regulated learners. Closing these gaps is an important step toward progress in the field and increasing the efficiency of existing educational strategies. Table 11 specifies pivotal gaps in the research on self-learning in progressing ubiquitous environments, thus suggesting areas that require future research.

Table 11: Identified Gaps in the Current Literature

Gap	**Implication for Future Research**
Limited Longitudinal Studies	More longitudinal research is needed to understand how SRL strategies evolve in ubiquitous environments.
Diverse Populations Understudied	Research predominantly focuses on higher education and adult learners, with limited studies involving younger learners or those from diverse socioeconomic backgrounds.
Impact of Cultural Factors	Few studies explore how cultural differences impact the adoption and effectiveness of SRL strategies in various regions.
Technological Advancements	As technology evolves rapidly, ongoing research is required to assess the effectiveness of new tools and platforms in supporting SRL.

These gaps suggest several directions for future research:

1. **Longitudinal Studies**: Future studies should focus on tracking learners over extended periods to observe changes and long-term outcomes related to SRL in ubiquitous environments. This approach will help identify sustained impacts and the possible decay of strategy effectiveness over time.

2. **Inclusive Research**: More research that includes diverse populations, particularly younger learners and those from different cultural or socioeconomic backgrounds, is needed. This inclusivity is the guaranteed approach to eavesdropping on a larger demographic in developing the strategy and applying the achieved findings.

3. **Cultural Impact Studies**: Inquiring into the role of surrounding culture in implementing the SRL strategy provides knowledge on designing tech and learning methodologies considering different global regions.

4. **Technological Developments**: Continuous research of new technologies and their actual educational proposals will help keep educational strategies in line with the latest upgrades. Research should be conducted to determine whether such new devices help as much as they claim in SRL.

Bridging these gaps, diversifying intellectual conversation, and providing practical usage guarantee the pace of education through new technology and cultural changes. The future-oriented research study conducted herein will tremendously strengthen the field by proposing multidimensional and inclusive strategies.

Emerging Trends and Technologies

The area of ubiquitous learning is eternally dynamic, being provoked by technological progress and educational paradigm shifts. Several new trends and innovations will lead to the future of self-led learning in a universal place. Key trends include:

1. **Artificial Intelligence (AI) in Education**: AI innovations, including adaptive learning tools and AI tutors, are gradually becoming worthy of mention. They provide customized educational practices that accommodate diverse learning requirements and biases.

2. **Augmented and Virtual Reality (AR/VR)**: These technologies offer interactive learning much more

involving and easier to grasp because reality is being reproduced. This is true for language study especially.

3.**Internet of Things (IoT)**: IoT devices have become integral to education, where physical and digital learning environments flawlessly interact, and real-time data provides information to support self-regulation.

4.**Blockchain for Education**: This technology offers new ways to preserve and verify educational achievements. It could also support personalized learning paths by safely storing data and learners' achievements over time.

These technologies enhance learning experiences and offer new avenues for research, particularly in understanding their impact on SRL behaviors and outcomes.

Recommendations for Future Studies

Given the identified gaps and emerging trends, the following recommendations are proposed for future research in the field of SRL in ubiquitous environments:

1. **Integrate New Technologies in Research**: Future studies should explore how the latest technologies, such as AI and VR, can effectively support and enhance SRL strategies, especially among diverse learning populations.

2. **Focus on Underrepresented Groups**: Expanding research to include a wider range of participants, including younger learners and those from varying cultural and socioeconomic backgrounds, is crucial to ensuring the generalizability of research findings.

3. **Conduct Cross-Cultural Studies**: More studies are needed that examine the cultural influences on SRL in ubiquitous environments to understand how cultural variables influence learning strategies and technology adoption.

4. **Longitudinal and Comparative Studies**: Longitudinal and comparative studies are needed better to understand SRL strategies' long-term effects and sustainability. Comparative studies between different technologies could provide insights into the most effective tools in various learning contexts.

5. **Develop and Test New Models of Self-Regulation**: As educational technologies evolve, so should the theoretical models that describe SRL. New or updated models incorporating recent technological advances and learning modalities should be developed and tested.

By addressing these recommendations, future research can provide deeper insights and more robust evidence to support effective SRL strategies in increasingly digital and ubiquitous learning environments. This will enhance academic knowledge and practical applications, improving educational outcomes across diverse and global learner populations.

CONCLUSION AND FUTURE WORK

This SLR has examined the mechanisms of SRL among language learners in today's omnipresent learning environments. The review has carefully investigated and presented the existing literature, highlighting the importance of the findings and determining the areas in which the research needs to be carried out in the future. The results demonstrate that ubiquitous learning ecologies can improve SRL by boosting accessibility to resources, learner autonomy, and personalization, making learning an individual experience. Also, these environments can bring difficulties like accelerated distraction, dependency on technology, and the variation of learner motivation and digital literacy skills.

Key conclusions drawn from this review include:

1.**Technological Integration**: Mobile apps, learning management systems, and gamification tools support

student self-regulation. Integrating learning technologies into the learning process will improve students' engagement and education achievement outcomes.

2. **Challenges**: Implementing self-directed learning approaches across ubiquitous environments is challenging and should be resolved by pinpointing the causes of distractions, technological overreliance, and motivation declines.

3. **Research Gaps and Trends**: The current literature has limitations mostly tied to longitudinal research, the involvement of various populations, and cultural influences. Future studies can use evolving tech such as AI, VR and IoT to explore all angles in self-paced educational delivery.

4. **Recommendations for Future Research**: Future investigations will involve implementing the latest technologies, expanding the area of research, conducting long-term and comparative studies, and developing new theories consistent with the modern digital world.

5. **Practical Implications**: This research's findings are important for educators and developers of ubiquitous learning environments who want to improve their environments. Experts can increase education's inclusiveness, engagement, and success by studying the factors that promote or hinder self-regulatory learning.

In conclusion, while ubiquitous environments hold considerable promise for revolutionizing language learning through self-regulated strategies, realizing this potential fully requires ongoing research and innovation. Addressing the identified gaps and embracing emerging trends will be key to advancing our understanding and implementing effective learning strategies in these digitally enhanced settings. This review serves as a foundation for such endeavors, providing a roadmap for future research and practical applications in the field of education.

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