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Using a Semantic-Web Based Program for Developing Pre-Service English Language Teachers' Teaching Competencies

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Abstract:

The research investigated the effectiveness of using a Semantic Web-based program in developing pre-service English Language teachers' teaching competencies. The research's instruments included a teaching competencies checklist and a competencies test and the Semantic Web-based program. Thirty-four major students at Hurghada Faculty of Education participated in the research as pre-service English language teachers. The participants studied the Semantic Web-Based program during the second semester of the academic year 2022/2023 at Hurghada Faculty of Education. They were post-tested to identify the effectiveness of the proposed program. The findings showed statistically significant differences between participants' mean scores in the pre-post testing favoring the post-testing in lesson planning, implementation and assessment. The results indicated that the Semantic Web was effective for pre-service English Language teachers because it provided interactive, diverse resources that enhanced engagement and facilitated personalized learning experiences. This approach significantly improved their competencies in lesson planning, implementation, and assessment by integrating theory with practical application. Recommendations suggested that customizing programs for varied educational contexts and investing in technological infrastructure were advised to enhance the effectiveness of Semantic Web tools in teaching.

Key Words: Semantic Web, pre-service, competencies.

Introduction

The integration of technology into education has expanded significantly in the last decades, leveraging the power of technological advancements to optimize learning outcomes. The use of a semantic approach in education aligns with the target of integrating technology in education to enhance the whole teaching environment. The Semantic Web has the potential to organize, connect information, and transform English language learning into a personalized, interactive, and collaborative experience. Hence, utilizing a Semantic Web holds a significant promise for developing teaching competencies of pre-service English language teachers.

Competencies are integrated abilities encompassing the entirety of knowledge, skills, and attitudes requisite for the successful and effective execution of a task or a related set of specific tasks (Al-Fatlawi, 2003). Competences also represent a composite of discerned skills and substantiated knowledge, encompassing the array of abilities that teachers must possess and exercise during their classroom instruction. These competencies span various domains, including content mastery, goal setting, utilization of teaching aids, instructional activities, teaching methodologies, classroom management, and assessment practices (Al-Ghaziwat, 2000).

In addition, developing competencies requires familiarity with developing knowledge, skills, and attitudes. Knowledge is the foundation of all learning, and skills are the ability to apply knowledge

practically. Attitudes are the beliefs and values that guide our behavior. The Ministry of National Education in Turkey (2007), emphasized that teacher competency is a demonstration of observable professional behavior in a certain given context ... guided by a mixture of knowledge, skills, attitudes, and personal characteristics. This perception underlines the idea that being a competent teacher goes beyond rote knowledge and extends into the field of practical application, interpersonal skills, and a deep understanding of the teaching context.

Additionally, the development of EFL teaching competencies has a positive impact on the quality of English language education and student achievement. According to (Celce-Murcia, Dörnyei & Thurrell, 1995), the development of EFL teaching competencies is essential for improving the quality of English language education and the success of students in achieving their learning goals. By investing in the development of teaching competencies, educational institutions aim to elevate the standard of English language education, ensuring that students are better equipped to meet their language learning objectives successfully.

The quality of English language education in Egypt holds potential for significant improvement through targeted initiatives aimed at enhancing the competencies of pre-service teachers. A fundamental approach to achieving this entails the introduction of comprehensive training programs. El-Dakhakhny (2019) underscored the efficacy of such an approach, highlighting the substantial positive influence that

pre-service teacher training focused on English language competencies can exert on the educational landscape. By equipping pre-service teachers with the necessary skills and knowledge through these training programs, the foundation for elevating the quality of English language education in Egypt can be firmly established. Consequently, the implementation of these training initiatives emerges as a crucial step towards ensuring that the country's English language education system thrives, benefitting both educators and learners alike.

The Semantic Web, envisioned by Tim Berners-Lee as an extension of the World Wide Web, aimed to enhance the accessibility and comprehension of online content for both humans and machines (Berners-Lee et al., 2001). This fundamental shift in information organization, transitioning from a web of documents to a web of data, hinges on the ability to represent meaning and context within the data itself. As highlighted by Shadbolt et al. (2006), the key difference between the current Web and the Semantic Web is that the latter provides an explicit, machine-readable representation of the semantics of information through the use of ontologies and other knowledge representation formalisms.

This ability to organize and connect information semantically holds significant potential to revolutionize the educational landscape. Berners-Lee et al. (2001) emphasize that with the Semantic Web, "educational resources can be linked in a meaningful way, making it easier for users

to find relevant information and for systems to make intelligent recommendations."

The Semantic Web has the potential to revolutionize English language learning by making it more personalized, interactive, and collaborative. This potential to provide learners with personalized learning can be achieved by providing learners with content and activities that are relevant to their individual needs and interests. Guo (2019) confirmed that the Semantic Web has the potential to revolutionize English language learning by making it more personalized, interactive, and collaborative. However. interactive learning can be supported by providing learners with opportunities to interact with content and with each other.

Context of the problem

Through sequential research steps beginning with a literature review and teachers survey followed by direct observation of student teachers during their practicum, significant gaps were found in teaching competencies, particularly in lesson planning, implementation, and assessment. This research underscores the need for targeted improvements in teacher training programs.

Statement of the problem

The problem of the research can be stated in the deficiency of lesson planning, implementation and assessment competencies among pre-service English Language teachers. This deficiency has notably affected

their ability to effectively assess students. Therefore, this research investigated the effect of a Semantic Web-based program as a potential means to enhance these particular aspects of competencies.

Questions of the Research

1. What are the essential teaching competencies required for EFL pre-service teachers?
2. What are the key characteristics of the Semantic Web-based program for enhancing lesson planning competencies of EFL pre-service teachers?
3. How effective is the Semantic Web program in developing classroom management and lesson implementation of EFL pre-service teachers?
4. What are the key characteristics of the Semantic Web-based program for enhancing the assessment competencies of EFL pre-service teachers?

The research attempted to verify the following hypotheses

- There would be statistically significant differences between the mean scores of the research participants in the pre-post-testing of lesson planning favoring the post-testing.

- There would be statistically significant differences between the mean scores of the research participants in the pre-post-testing of implementation favoring the post-testing.

- There would be statistically significant differences between the mean scores of the research participants in the pre-post testing of assessment competencies favoring the post-testing.

Significance of the research

This research might be significant for:

- Exploring the potential of Semantic Web technologies to improve training programs for pre-service English language teachers.
- customizing intelligent tutoring systems for teachers to deliver personalized feedback to students to improve their competencies.
- facilitating teachers' tasks in tracking and assessing students' progress through the integration of suitable technological applications.
- Providing course designers with innovative tools for designing personalized and adaptive learning experiences.

Design of the research

The current research followed a quasi-experimental one-group design, which means that there is only one group of participants to be pre-post tested in the research and no control group is used.

Delimitations

The present research was delimited to the following

a. A group of (34) students in the fourth year of EFL major at Hurghada Faculty of Education

b. Teaching competencies (Lesson planning- implementation- Assessment)
c. The second semester of the academic year 2022/2023.

Definition of terms

Semantic Web

The Semantic Web is an extension of the World Wide Web that aims to provide machines with the ability to understand the meaning of information (Berners-Lee, Hendler, & Lassila, 2001). This is achieved through the use of formal languages like Resource Description Framework (RDF) and ontologies, which give data explicit structure and semantics, enabling machines to reason, infer, and make connections between data points, fostering data-driven intelligence and personalized user experiences. It can be inferred from this definition that Semantics is the research of meaning and therefore the Semantic Web implies "a web of meaning". The World Wide Web Consortium (W3C) defined it to be; “The Semantic Web is an evolving extension of the World Wide Web that aims to provide machines with the ability to understand the meaning of information, enabling them to reason, infer, and make intelligent connections between data. It achieves this through a suite of technologies, including Resource Description Framework (RDF), Ontologies and Linked Data” (W3C, 2023).

In the context of the current research, the operational definition of the Semantic Web is: It is an advanced and interconnected information space that utilizes standardized protocols, ontologies, linked data and

semantic technologies. This facilitates the creation of intelligent, personalized learning environments, enabling pre-service teachers to effectively develop and improve their teaching competencies.

Competencies

Competencies encompass the ability to apply a set of interconnected knowledge, skills, and attributes essential for proficiently executing critical work functions or tasks within a defined work environment. They can be defined as "the amalgamation of knowledge, skills, and experience required for the future, materializing in practical activities" (Katane, Aktan, & Gurol, 2006, p. 44). Competencies serve as the bedrock for skill standards, delineating the requisite level of knowledge, skills, and abilities indispensable for success in the workplace. They also serve as potential criteria for assessing the attainment of competency.

Al-Fatlawi (2003, p.27) defined competencies as a collection of knowledge, skills and attitudes that are needed to execute a task or some specific tasks stating "an integrated ability encompassing the entirety of knowledge, skills, and attitudes requisite for the successful and effective execution of a task or a related set of specific tasks". In addition, Al-Al-Ghaziwat (2000, p.5) clarified that teaching competencies represent a composite of discerned skills and substantiated knowledge, encompassing the array of abilities that teachers must possess and exercise during their classroom instruction. These competencies span

various domains, including content mastery, goal setting, utilization of teaching aids, instructional activities, teaching methodologies, classroom management, and assessment practices.

The researcher defined competencies operationally as; a comprehensive set of knowledge, skills, and attitudes demonstrably utilized to effectively plan, implement, and assess English language courses. These competencies manifest in observable and measurable behaviors reflecting a deep understanding of language pedagogy, effective teaching practices, and the ability to foster student learning and skills development.

Literature Review and Related Studies

The Significance of competences in education

Before discussing the significance of competencies in education, it's important to distinguish between competence and competency. Although these terms are often used interchangeably, they carry distinct meanings. Competency refers to the ability to perform a specific task, whereas competence encompasses a broader aptitude. In the context of language learning, competencies refer to specific language skills such as grammar, vocabulary, pronunciation, and intercultural competency. On the other hand, competence signifies the overall capacity to use language effectively for communicative purposes.

Moghabghab et al. (2018) emphasized that competence typically characterized a person's general capability, while competency described a person's specific ability to execute a particular task. Competence addresses what individuals can do, while competency delves into how they accomplish it. An individual's competence is their consistent integration of the knowledge, skills, and assessments necessary to perform their work safely, ethically, and effectively.

Competences represent a dynamic capacity to apply a comprehensive set of interconnected knowledge, skills, abilities, and attributes within specific work contexts. As outlined by Katane, Aktan, and Gurol (2006), competencies are characterized by a fusion of knowledge, skills, and experiential insights that find tangible expression through practical activities. These competencies serve as foundational pillars for establishing skill standards, defining the requisite level of expertise, knowledge, and abilities demanded for success in a given professional milieu. Moreover, they serve as vital yardsticks for evaluating and gauging the attainment of competency, providing a concrete framework for assessing individuals' readiness to excel in their respective roles within the workplace. In essence, competencies form the bedrock upon which individuals build their proficiency and expertise, laying the groundwork for success in diverse occupational domains.

According to Al-Fatlawi (2003, p. 28), teaching competencies encompass a comprehensive array of knowledge, skills, and attitudes, all

of which are indispensable for effective teaching. This conceptualization underscores the complexity inherent in the teaching profession, highlighting that proficiency extends beyond mere knowledge and technical skills to include the appropriate dispositions and attitudes. Competence, therefore, is not merely about performing tasks or possessing information but involves a dynamic capability to effectively navigate the multifaceted environment of education. In this light, a teacher's competence is viewed as a holistic indicator of their effectiveness, showcasing their ability to motivate, engage, and facilitate the development of their students through a diverse and integrated set of abilities

Distinguishing these diverse enables the creation of specialized training and development programs, specifically designed to meet the unique requirements of language teachers. This ensures that pre-service teachers are equipped to tackle the challenging and rewarding work of classroom practice. Beyond theoretical knowledge, the ability to apply this knowledge in three key areas is paramount:

- The cornerstone of successful teaching is anchored in the creation of meticulously structured lesson plans. Such development hinges on the ability to devise activities that are both engaging and meaningful, ensuring they align with educational goals and make effective use of relevant materials and resources (Richards & Lockhart, 1994).

- When it comes to implementation, the essence of skillful teaching is the ability to bring these plans to life in the classroom through a blend of flexibility and innovation, adjusting to the ever-changing classroom dynamics. This includes managing the diverse needs of students, encouraging their active involvement, and applying a variety of instructional strategies (Birch & Lange, 2015).
- In terms of assessment, the ongoing evaluation of learners' progress and the adjustment of future teaching plans are vital components of language education. This process goes beyond conventional testing to embrace performance-based evaluations that mirror authentic language scenarios, offering a comprehensive view of learners' progress (Brown, 2004).

Investing in dedicated training across these three interconnected areas empowers pre-service teachers to not only possess knowledge but also translate it into effective teaching practices. This comprehensive approach lays the foundation for successful language learning outcomes, preparing future educators to guide their students toward achieving mastery and equipping them with the necessary skills to thrive in a globalized world.

2. The Significance of The Semantic Web in Education

The Semantic Web is not merely a technological evolution but a pedagogical revolution in education. Through personalized learning, knowledge graphs, efficient content management, and enhanced collaboration, it empowers educators and learners alike. As the

educational landscape continues to evolve, embracing the Semantic Web is not just an option but a necessity to unlock the full potential of education in the digital age.

Berners-Lee, (2001, p.34) identified that the Semantic Web is about enriching the content of documents for the benefit of human users and computers. Embracing this enrichment, education can transcend boundaries and usher in a new era of knowledge dissemination and acquisition. As originally envisioned, the Semantic Web is a system that enables machines to "understand" and respond to complex human requests based on their meaning. Such an "understanding" requires that the relevant information sources be semantically structured. In addition, it represents the new generation of computer science which enables the computer to process a huge amount of information by understanding it.

In addition, Szeredi and Lukácsy (2014, p.471) underlined that the Semantic Web is a new area of research and development in the field of computer science that aims to make it easier for computers to process the huge amount of information on the Web, and indeed other large databases, by enabling them not only to read but also to understand the information. The Semantic Web is still in its early stages of development, but it has the potential to revolutionize the way we interact with the web. The Semantic Web enhances the ability of computers to comprehend online content, paving the way for the development of novel and groundbreaking applications that are currently unattainable.

The Semantic Web is an important movement led by international standards of the World Wide Web Consortium which allows data to be shared and reused across applications. According to the W3C the Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries. The main purpose of the Semantic Web is driving the evolution of the current web by enabling users to find, share and combine information more easily.

In the same manner, Ohler (2008) argued that the Semantic Web can be used to develop personalized learning experiences for students by providing them with assessments that are designed to their individual needs and interests. This can help students to learn more effectively and efficiently and to reach their full potential. The Semantic Web can be used to understand the unique learning needs of each student and to develop assessments that are specifically designed to address those needs. This can be done by using the Semantic Web to understand the student's prior knowledge, learning goals, and preferred learning style. The Semantic Web can also be used to develop adaptive assessments that adjust to the student's performance in real time.

In addition, the Semantic Web can revolutionize education by making it possible for students to learn at their own pace and in their way, and for teachers to provide personalized feedback and guidance. The

Semantic Web can be used to create personalized learning experiences for students and develop adaptive assessment tools. The Semantic Web can revolutionize education by making it possible for students to learn at their own pace and in their way, and for teachers to provide personalized feedback and guidance (Chauhan, 2016). Furthermore, Czerkawski, (2012) highlighted that the Semantic Web tools can give each student the ability to process information at their own pace. Overall, the Semantic Web has the potential to make education more personalized, effective, and efficient.

Similarly, Rubens, Kaplan, and Okamoto's statement (2011) pointed out the remarkable potential of the Semantic Web in modern education. The prospect of adaptive assessment tools that offer real-time feedback is revolutionary. Such tools can finely tune learning experiences, ensuring they align precisely with each student's needs. By harnessing semantic technologies, these assessments can dynamically adapt, promoting deeper comprehension and personalized learning journeys. This not only empowers learners to track their progress but also provides educators with invaluable insights for tailored instruction. The Semantic Web can be used to develop adaptive assessment tools that provide students with feedback and guidance on their learning progress in real time (Rubens, Kaplan, & Okamoto, 2011). The Semantic Web's role in shaping education into a more responsive, data-informed, and effective enterprise is a testament to its transformative capacity.

Furthermore, El-Khodary and El-Dakhakhny (2020) identified that the Semantic Web can facilitate the development of intelligent tutoring systems, personalized learning experiences, and adaptive learning environments, empowering machines to understand the relationships between concepts and data. Additionally, El-Dakhakhny (2019) emphasized that the Semantic Web can enhance the discoverability of educational resources by providing a standardized framework for organizing and indexing information, making it easier for educators and learners to locate the resources they require.

Commentary

This research emphasized the importance of integrating technology into teaching methodologies, particularly in the context of pre-service EFL education. It focused on enhancing key teaching competencies, including lesson planning, implementation, and assessment, through the use of the Semantic Web.

The Semantic Web, an advanced technological tool, provides an interactive and interconnected platform, revolutionizing traditional teaching methods. It offers pre-service EFL teachers' innovative ways to approach lesson planning, making plans comprehensive and adaptable to diverse learner needs. This technology enables teachers to create more engaging and effective classroom experiences, utilizing multimedia resources, interactive content, and real-time feedback mechanisms. Such tools are instrumental in the effective implementation of lesson plans.

Assessment is another crucial aspect explored in this research. The Semantic Web facilitates access to novel assessment tools, allowing teachers to conduct detailed evaluations of student performance. This capability is vital for providing immediate feedback and tailoring future teaching strategies to meet student needs more effectively.

Overall, the study investigates how a Semantic-Web Based Program can transform the competencies of pre-service EFL teachers in lesson planning, implementation, and assessment. It highlights the relevance of these competencies in modern educational settings and the growing reliance on technology in education. This research is significant in understanding how advanced web technologies can enhance the teaching capabilities of future educators, equipping them to effectively navigate the complexities of 21st-century language education.

Method and Procedures:

Participants:

The participants of the research were 34 EFL pre-service teachers, all fourth-year students from the English Department at Hurghada Faculty of Education, during the second semester of the 2022/2023 academic year.

Design:

This research adopts a quasi-experimental one-group pre-post-test design to evaluate the effectiveness of a Semantic Web-based program in developing the competencies of EFL pre-service teachers

Variables:

Independent variable: the Semantic Web-based program.

Dependent variable: teaching competencies of EFL pre-service teachers.

Instruments :

To achieve the research aims, the following instruments were utilized:

1- Teaching competencies checklist.
2- Teaching competencies test.
3- A Semantic Web-based program.

Scoring: The scoring scale ranges from "Excellent" (4 points) to "Weak" (1 point), with total marks ranging from 27 to 108.

Validity: The sheet's validity was ensured through simple and content validity checks, including verification by a panel of TEFL experts.

Reliability of the Observation Sheet:

1. **Inter-rater Method:** Two observers used the same observation sheet to ensure consistency and reduce subjectivity. The Pearson

coefficient was found to be .92, indicating high reliability at the 0.01 level.

2. **Split-Half Method:** The Split-Half (Spearman-Brown) method was used, yielding a reliability coefficient of 0.79, indicating strong reliability.

1- Testing the first hypothesis

Hypothesis 1: There would be statistically significant differences between the mean scores of the study participants in the pre-post testing of lesson planning competencies favoring the post-testing.

The analysis of the data using the t-test showed that the participants demonstrated a higher level of improvement in lesson planning, as their post-test scores were higher than their pre-test scores. Table (1) shows that the post-test mean score is higher than the pre-test one, which indicates an improvement in the participants' lesson planning competencies. This improvement may be attributed to the effect of the proposed program on the sample

Table (1)

The differences between the pre- post-test of lesson planning competences (No=34)

Variable	No.	Pre-test		Post-test		DF	Indication Level	T Value	2 η
		Mean	S. D.	Mean	S. D.				
Lesson planning	34	8.03	0.93	9.38	1.04	33	0.00	10.19	Significant

Table (1) showed that the mean score for the pre-test was 8.03, which increased to 9.38 in the post-test, with a calculated t-value of 10.19. This t-value is statistically significant, exceeding the critical t-value of 2.02 at the 0.01 significance level for 33 degrees of freedom. Consequently, this significant increase in mean scores from the pre-test to the post-test among pre-service English Language teachers indicates a substantial improvement in lesson planning competencies. Such improvement, attributed to the intervention with the Semantic Web-based program, underscores the program's effectiveness in enhancing these competencies. The observed effect size indicates a strong impact of the program on developing lesson planning competencies.

2- Testing the second hypothesis

Hypothesis 2: There would be statistically significant differences between the mean scores of the study participants in the pre-post testing of implementation competencies favoring the post-testing.

The analysis of the data using the t-test showed that the participants demonstrated a higher level of improvement in implementation competencies, as their post-test scores were higher than their pre-test scores. Table (2) shows that the post-test mean score is higher than the pre-test one, which indicates an improvement in the participants' implementation competencies. This improvement may be attributed to the effect of the proposed program on the sample

Table (2)

The differences between the pre-post-test of implementation competences (No=34)

Variable	No.	Pre-test		Post-test		DF	Indication Level	T Value	η^2
		Mean	S. D.	Mean	S. D.				
Implementation	34	8.24	0.95	10.26	1.21	33	0.00	10.89	Significant

Table (2) displayed the mean score of the pre-test was 8.24, which increased to 10.26 in the post-test, with a notable t-value of 10.89. This t-value significantly exceeds the critical value of 2.02 at the 0.01 significance level for 33 degrees of freedom, indicating statistical significance. Such a marked improvement in mean scores from pre-test to post-test among pre-service English teachers demonstrates a

significant enhancement in implementation competencies. This enhancement is directly attributable to the intervention with the Semantic Web-based program, signifying its effectiveness in bolstering these competencies. The strong effect size observed further confirms the substantial impact of the program on improving implementation skills.

3- Testing the third hypothesis

Hypothesis 3: There would be statistically significant differences between the mean scores of the study participants in the pre-post testing of assessment competencies favoring the post-testing.

The analysis of the data using the t-test showed that the participants demonstrated a higher level of improvement in assessment, as their post-test scores were higher than their pre-test scores. Table (3) shows that the post-test mean score is higher than the pre-test one, which indicates an improvement in the participants' assessment competencies. This improvement may be attributed to the effect of the proposed program on the sample

Table (3)

The differences between the pre-post-test of assessment competences (No=34)

Variables	No.	Pre-test		Post-test		DF	Indication Level	T Value	2 η
		Mean	S. D.	Mean	S. D.				

Assessment competencies	**34**	**7.91**	**0.86**	**10.00**	**1.4**	**33**	**0.00**	**9.82**	**Significant**

Table (3) showed that the pre-test mean score was 7.91, which increased to 10.00 in the post-test with a notable t-value of 9.82. This t-value significantly exceeds the critical value of 2.02 at the 0.01 significance level for 33 degrees of freedom, indicating statistical significance This considerable enhancement in mean scores from the pre-test to the post-test among pre-service English teachers indicates a significant improvement in assessment competencies. Such progress is attributed to the application of the Semantic Web-based program, highlighting its efficacy in enriching these competencies. The observed effect size confirms the impact of the program on strengthening assessment skills.

Discussion

This research aimed to evaluate the impact of a Semantic Web-based program on developing key teaching competencies among pre-service English Language teachers, focusing on lesson planning, implementation, and assessment competencies. The findings from the hypothesis testing reveal significant improvements across all three areas, underscoring the effectiveness of using the Semantic Web-based program in enhancing teaching competencies.

The substantial improvement in lesson planning competencies, as evidenced by the increase in mean scores from the pre-test to the post-

test, highlights the program's role in equipping pre-service teachers with the necessary skills to design effective and engaging lesson plans. This aligns with educational research advocating for the integration of technology to facilitate detailed and adaptable planning processes.

Similarly, the significant gains in implementation competencies indicate that the program effectively prepared the participants to translate their lesson plans into action within the classroom. This suggests that the program not only focuses on the theoretical aspects of lesson planning but also emphasizes practical application, ensuring that pre-service teachers are capable of dynamically engaging students and managing classroom activities effectively.

The improvement in assessment competencies is particularly noteworthy. The ability to accurately and constructively evaluate student performance is critical for effective teaching and learning. The observed enhancements in this area demonstrate the program's success in imparting comprehensive assessment skills to pre-service teachers, enabling them to utilize a variety of assessment tools and techniques to gauge student understanding and progress.

These findings indicated that the Semantic Web-based program served as a valuable tool in the professional development of pre-service English Language teachers, addressing critical gaps in traditional teacher education programs. The program's effectiveness in improving lesson

planning, implementation, and assessment competencies underscored its potential as a transformative educational resource.

Interpretations

The findings from this study provide insightful implications for the integration of the Semantic Web in pre-service EFL education, particularly in enhancing competencies related to lesson planning, implementation, and assessment. The significant improvements observed across all competencies post-intervention suggest that the Semantic Web-based program serves as a powerful tool in augmenting the instructional capabilities of future educators. These enhancements are critical in preparing pre-service teachers to navigate the complexities of modern educational environments, where technological adeptness is increasingly becoming a foundational element of effective teaching.

This research contributes to the broader discourse on educational competencies by demonstrating how specific, targeted interventions can lead to substantive improvements in the capabilities of pre-service teachers. The Semantic Web, by facilitating access to and the application of diverse educational resources, supports a more dynamic and personalized approach to teaching and learning. This aligns with contemporary educational paradigms that prioritize adaptability, learner-centered pedagogies, and the integration of technology in the classroom.

Suggestions for Further Studies

- Expanding the research to include diverse educational contexts, including primary, secondary, and higher education, could reveal how the Semantic Web's impact varies across different age groups and learning environments.
- Investigating the effectiveness of Semantic Web-based programs in different cultural settings could provide valuable insights into how cultural variables influence the adoption and impact of technology in education.
- Exploring the integration of Semantic Web technologies with other emerging technologies, such as artificial intelligence, virtual reality, and blockchain, could uncover new possibilities for enhancing teaching competencies and transforming educational practices.
- Further research could delve into the perceptions, attitudes, and challenges faced by teachers in integrating Semantic Web technologies into their teaching practices. Understanding these aspects could inform the development of more effective training programs and support systems.
- While this study focused on teacher competencies, subsequent research should also examine the direct impact of Semantic Web-based teaching on student learning outcomes, engagement, and motivation.

Recommendations:

Several recommendations emerged from the findings, advocating for a multifaceted approach to incorporate Semantic Web technologies in EFL teaching.

- Updating teacher education curricula to encompass modules on Semantic Web tools and their EFL teaching applications is also advised, ensuring new teachers are proficient in contemporary educational technologies.
- Providing continuous professional development opportunities for current teachers to enhance their skills with the latest Semantic Web technologies is suggested.
- Longitudinal studies are recommended to evaluate the long-term effects of such programs on teaching practices and student learning outcomes. It's also proposed to customize the Semantic Web-based programs to suit various educational contexts and student demographics for optimal effectiveness.
- Investing in the technological infrastructure of educational institutions is deemed necessary to facilitate the broad use of Semantic Web tools.
- Encouraging partnerships between educators and technology experts is recommended to keep Semantic Web-based teaching tools up-to-date and effective.

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