Improving integrative methodology for developing reading competence in English for chemistry students

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Annotation. *This article aims at enhancing integrative methodology to develop reading competence in English for chemistry students. Given the interdisciplinary nature of chemistry, students must acquire specialized reading skills to comprehend scientific texts effectively. The methodology integrates content-based instruction (CBI), task-based learning (TBL), and metacognitive reading strategies to enhance students' reading proficiency. The article explores the impact of this methodology on students' academic performance and engagement.*
Keywords: *Integrative methodology, reading competence, English for specific purposes, chemistry students, content-based instruction, task-based learning, metacognitive strategies.*

Улучшение интегративной методологии для развития компетенции чтения на английском языке для студентов-химиков

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Аннотация. *Целью данной статьи является улучшение интегративной методологии для развития компетенции чтения на английском языке для студентов-химиков. Учитывая междисциплинарный характер химии, студенты должны приобрести специализированные навыки чтения для эффективного понимания научных текстов. Методология объединяет обучение на основе содержания (CBI), обучение на основе задач (TBL) и метакогнитивные стратегии чтения для повышения навыков чтения студентов. В статье рассматривается влияние этой методологии на успеваемость и вовлеченность студентов.*
Ключевые слова: *интегративная методология, компетентность в чтении, английский язык для специальных целей, студенты-химики, обучение на основе содержания, обучение на основе задач, метакогнитивные стратегии.*

Kimyo yo‘nalishi talabalarining ingliz tilida o‘qish kompetensiyasini rivojlantirishning integrativ metodikasini takomillashtirish

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Annotatsiya. *Mazkur maqola kimyo yo‘nalishi talabalari uchun ingliz tilida o‘qish kompetensiyasini rivojlantirish uchun integrativ metodikasini takomillashtirishga qaratilgan. Kimyoning fanlararo xususiyatini hisobga olgan holda, talabalar ilmiy matnlarni samarali tushunish uchun maxsus o‘qish ko‘nikmalarini egallashlari kerak. Ushbu integrativ metodika talabalarning*

o‘qish malakasini oshirish uchun sohaga asoslangan o‘qitish (CBI), topshiriqaa asoslangan ta'lim (TBL) va metakognitiv o‘qish strategiyalarini o‘z ichiga oladi.

Kalit so‘zlar: *Integral metodologiya, o‘qish kompetensiyasi, aniq maqsadlar uchun ingliz tili, kimyo talabalari, kontentga asoslangan ta'lim, vazifaga asoslangan ta'lim, metakognitiv strategiyalar.*

Introduction. Reading competence is crucial for chemistry students as scientific texts are predominantly in English. Traditional language instruction often fails to address the specialized vocabulary, discourse structures, and analytical reading skills required for comprehending chemistry-related literature. As a result, students may struggle to interpret research papers, textbooks, and technical documents, which are essential for their academic and professional success. Given the rapid advancements in scientific research and the global nature of scientific communication, chemistry students must be equipped with effective reading strategies that enable them to engage critically with texts. Integrating language and subject-matter instruction has been recognized as an effective approach to developing reading competence in English for Specific Purposes (ESP) contexts. However, there is still a need for systematic models that provide structured methodologies for improving reading skills in chemistry education. This article presents an integrative methodology that combines linguistic and subject-specific competencies to enhance reading proficiency. By incorporating content-based instruction, task-based learning, and metacognitive strategies, the proposed model aims to bridge the gap between language learning and scientific literacy. The study explores the impact of this integrative approach on students’ reading abilities and its potential for fostering deeper engagement with scientific texts.

Literature Review. Reading competence in ESP contexts is a critical aspect of academic success, particularly in scientific disciplines like chemistry. Hutchinson and Waters (1987) emphasize that ESP learners require a more focused approach to language learning that considers discipline-specific conventions and terminology. In the field of chemistry, students encounter dense scientific texts filled with complex vocabulary, specialized discourse structures, and multimodal representations, such as chemical formulas, reaction mechanisms, and data tables. Without adequate training in discipline-specific reading strategies, students may struggle to interpret and synthesize information effectively. Hyland (2006) highlights the importance of providing learners with targeted instruction that integrates both linguistic and subject-matter knowledge to develop their reading competence. Therefore, adopting an integrative approach that fosters reading strategies tailored to the complexities of scientific texts is essential for enhancing students' comprehension and engagement.

Content-Based Instruction (CBI) has gained widespread recognition as an effective approach to language learning, particularly in ESP contexts. Brinton, Snow, and Wesche (2003) argue that CBI facilitates the simultaneous development of linguistic skills and subject knowledge by embedding language instruction within relevant disciplinary content. In chemistry education, CBI can be implemented by incorporating authentic scientific texts, research articles, and laboratory reports into the curriculum, thereby allowing students to engage with real-world language use. Additionally, Task-Based Learning (TBL) offers a complementary approach by emphasizing learning through meaningful tasks (Ellis, 2003). In the context of reading competence, TBL encourages students to actively engage with texts by performing tasks such as summarizing research findings, analyzing experimental procedures, and discussing scientific arguments. The integration of CBI and TBL creates a dynamic learning environment that enhances students’ reading comprehension, fosters critical thinking, and improves their ability to apply knowledge in academic and professional settings.

Besides, metacognitive strategies play a pivotal role in the development of reading competence, particularly in the context of specialized disciplines like chemistry. According to O‘Malley and Chamot (1990), metacognitive strategies involve planning, monitoring, and evaluating one's reading processes, which can significantly enhance comprehension and retention. Chemistry students, in

particular, benefit from strategies such as predicting content based on prior knowledge, identifying key information within complex texts, and self-monitoring comprehension through annotation and summarization. Effective use of these strategies enables students to navigate challenging scientific texts with greater confidence and independence. Moreover, research by Anderson (2002) suggests that explicit instruction in metacognitive strategies leads to measurable improvements in students' reading proficiency. By incorporating metacognitive training into the integrative methodology, educators can equip chemistry students with the skills needed to become more autonomous and strategic readers, ultimately enhancing their academic and professional competencies.

Methodology. This developed methodology was implemented in an undergraduate chemistry course where students were exposed to integrative reading activities and employed a mixed-methods approach, using pre- and post-tests to measure reading competence and qualitative feedback to assess student engagement. Participants were assigned reading tasks that incorporated CBI, TBL, and metacognitive strategies.

Findings and Discussion. Results indicate that students who engaged with the integrative methodology demonstrated higher comprehension levels and greater confidence in reading chemistry-related texts. The structured approach allowed for better retention of specialized vocabulary and improved analytical skills. Furthermore, student feedback highlighted the effectiveness of interactive and task-based learning experiences in facilitating deeper understanding.

In addition to improved comprehension, students reported feeling more engaged with the reading material. Many participants noted that the integration of subject-specific content with reading strategies helped them relate theoretical concepts to practical applications, making the learning process more meaningful. The task-based learning component, in particular, was found to be beneficial in reinforcing reading comprehension through hands-on activities such as text summarization, discussion-based problem-solving, and collaborative text analysis.

Furthermore, the study found that students who received explicit instruction in metacognitive strategies developed a greater awareness of their own reading processes. They were able to apply strategies such as skimming for key information, annotating important points, and self-assessing their comprehension levels, leading to more independent learning. This suggests that metacognitive training can be a valuable component of an integrative reading methodology. See the lesson sample below.

Lesson plan: Analyzing and Summarizing Scientific Texts in Chemistry

Objectives:

By the end of the lesson, students will be able to

- enhance students' reading competence in English by engaging them in active reading, comprehension, and application of chemistry-related texts.
- apply content-based instruction (CBI), task-based learning (TBL), and metacognitive reading strategies.

Materials:

- A selected scientific article or textbook excerpt related to a chemistry topic (e.g., reaction mechanisms, spectroscopy, or thermodynamics).
- Worksheet with guiding questions for analysis and reflection.

Instructions:

1. **Pre-Reading (Activation of Prior Knowledge & Prediction)**

Students skim the text and identify key terms, headings, and figures.

Discuss in pairs: *What do you already know about this topic? What do you expect to learn from the text?*

Highlight unknown vocabulary and use contextual clues to infer meanings before using a dictionary.

2. **While-Reading (Comprehension & Analysis Tasks)**

Task 1: Identifying Main Ideas
Read the text carefully and summarize the main findings in one paragraph.
Task 2: Understanding Structure
Label different sections (Introduction, Methodology, Results, Discussion) and describe their purpose.
Task 3: Extracting Key Information
Answer guiding questions, such as:
-What is the primary research question or objective?
-What methods were used?
-What are the key findings?
Task 4: Application & Critical Thinking
How does this information connect to prior knowledge or lab work?
What are the possible real-world applications of these findings?
3. **Post-Reading (Reflection & Discussion)**
In small groups, discuss the implications of the study.
Use metacognitive strategies:
- *What strategies helped you understand the text?*
- *What difficulties did you encounter, and how did you overcome them?*

4. **Extension Task (Task-Based Learning)**
- Students create a short presentation or infographic summarizing the article's key points.
- Peers provide feedback using a structured rubric focusing on clarity, accuracy, and presentation skills.

Assessment:
-Completion of worksheets and group discussions.
-Evaluation of student summaries and presentations based on comprehension and clarity.

Overall, the findings support the effectiveness of the integrative approach in fostering reading competence in chemistry students. The combination of content-based instruction, task-based learning, and metacognitive strategies provided a well-rounded framework that enhanced both linguistic proficiency and subject knowledge. However, the study also highlights the need for continuous refinement of instructional materials to ensure accessibility and alignment with students' varying proficiency levels. Future studies could explore long-term effects of this model and its adaptability to other scientific disciplines.

Conclusion and Recommendations. To conclude, by combining CBI, TBL, and metacognitive strategies, educators can create a more engaging and effective reading curriculum. The findings suggest that integrative approaches help students develop deeper comprehension, increase their engagement with texts, and enhance their critical thinking skills. Future research should explore the long-term impact of this model, examine its scalability to different academic levels, and assess its effectiveness in various scientific disciplines. Additionally, training programs for educators should emphasize the integration of linguistic and subject-specific instruction to maximize student learning outcomes.

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