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FROM TECHNOLOGIES TO INTERACTIONS: AN ANALYSIS OF SELF-EFFICACY IN DIVERSE ASPECTS OF ONLINE LEARNING

Abstract. Understanding self-efficacy—the belief in one’s ability to succeed—is crucial as students navigate and engage in virtual classrooms. This study investigates self-efficacy in online learning using the Self-Efficacy Questionnaire for Online Learning (SeQoL). The research focuses on five critical aspects: completing online courses, social interaction with classmates, proficiency in using a Course Management System (CMS), interactions with instructors, and academic engagement with peers. A mixed-methods approach was adopted. The SeQoL questionnaire was administered to 50 students from two Ukrainian universities: National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Descriptive and inferential statistical analyses, including correlation tests, were conducted to explore relationships between self-efficacy dimensions and academic success. The analysis revealed strong self-efficacy in adapting learning strategies, grasping complex ideas, and fostering social connections with peers. Notable strengths included developing friendships and utilizing CMS tools, such as submitting assignments and engaging in discussions. However, challenges emerged in managing deadlines and clearly communicating

with instructors during unexpected situations. The correlation between self-efficacy and academic success was significantly positive ($r \approx 1.3086$). This research sheds light on critical dimensions of self-efficacy in online learning, highlighting areas where Ukrainian students excel and where they require additional support. The findings are particularly relevant for improving online education amidst the challenges posed by war and digital transformation. Insights from this study are essential for educators, institutions, and policymakers aiming to enhance the effectiveness and inclusivity of online learning environments in Ukraine.

Keywords: Self-efficacy, Online learning, Educational technology, Social interactions, Course Management System (CMS), Academic collaboration, Learning empowerment, Time management.

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ВІД ТЕХНОЛОГІЙ ДО СОЦІАЛЬНОЇ ВЗАЄМОДІЇ: АНАЛІЗ САМОЕФЕКТИВНОСТІ У РІЗНИХ АСПЕКТАХ ОНЛАЙН- НАВЧАННЯ

Анотація. Одним із чинників, які впливають на успішність студентів, є самоефективність — віра у власну здатність виконувати завдання та досягати поставлених цілей в умовах онлайн-навчання. Метою статті є дослідження рівня самоефективності в різних аспектах дистанційного навчання: опануванні онлайн-курсів, соціальній взаємодії з однолітками та викладачами, цифровій компетентності. Кількісне дослідження передбачало проведення опитування за допомогою шкали самоефективності SeQoL серед 50 студентів

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Ключові слова: самоефективність, онлайн-навчання, освітні технології, соціальна взаємодія, система управління курсами (CMS), академічна співпраця, розвиток навчальних можливостей, управління часом.

Introduction. Online education has evolved rapidly in recent years, with technical advancements enabling learning to go beyond traditional paths. As students become more involved in virtual classrooms, it is crucial to comprehend the elements that affect their performance in this setting. One of these important factors is self-efficacy – the belief in one's ability to complete tasks and achieve goals in an online learning context.

The advancement of online education has brought about many barriers and opportunities. A challenge of remote learning is maintaining student motivation and engagement in an online environment, which may sometimes lack the direct interaction that exists in traditional classrooms. Technical issues, including internet connectivity and digital proficiency, can pose challenges for both educators and learners. At the same time, online learning offers increased flexibility in scheduling, a greater variety of courses, and access to peers from different backgrounds and perspectives from around the world, all of which enhance the overall educational experience.

Literature review. Research on self-efficacy in online learning has gained attention, emphasizing its central role in shaping student behavior, engagement, and overall success. Bandura's Social Cognitive Theory provides a fundamental framework for understanding self-efficacy and asserts that individuals' beliefs in

their abilities profoundly influence their actions and persistence [1]. Key determinants include past experiences of success and failure, cognitive, emotional, and physiological factors, observation of others' accomplishments, and the ability to attain personal goals [2].

In reviewing the literature, self-efficacy is defined as individuals' judgment of their capability to organize and execute actions necessary to attain predetermined objectives [2]. This concept includes competencies essential for success and confidence in one's ability to execute tasks toward goal achievement. Studies highlight the importance of self-efficacy in technological environments. The ability to proficiently use digital tools such as course management systems (CMS) is a crucial aspect of online learning self-efficacy [3, 4]. However, a need remains to address the challenges and opportunities students encounter when using these tools.

Online learning self-efficacy incorporates students' beliefs in their ability to perform tasks required for online learning, influencing their learning outcomes and satisfaction [3]. Its dimensions include completing online courses, interacting socially and academically with classmates, handling tools in a CMS, and interacting with instructors [5, 6]. Self-efficacy in online learning is positively correlated with academic performance and satisfaction. Higher self-efficacy improves engagement with learning systems, peer interactions, and course conveners [7, 8]. It also reduces task anxiety and enhances participation and performance in online activities [9, 10]. Several factors influence online learning self-efficacy, including prior experience, demographic variables, and digital literacy. Positive attitudes and high digital literacy significantly contribute to self-efficacy [6, 8].

Despite its importance, challenges remain in fully understanding self-efficacy across asynchronous and synchronous environments. Amidst the COVID-19 pandemic, the transition to online formats posed challenges for students and educators. Given the predictive role of self-efficacy in academic success, assessing these levels is imperative. Social interactions in online learning also play a critical role. Collaborative activities and meaningful exchanges mitigate isolation, enhancing motivation and cognitive engagement [11, 12]. The SeQoL questionnaire offers a valuable tool for examining self-efficacy in online learning, providing insights for educators and institutions to enhance support mechanisms for effective online education [6].

Even though a number of online learning-related topics have been investigated, there is still a lack of knowledge regarding the complex dynamics of self-efficacy across a range of dimensions in the Ukrainian context. The goal of this research is to address this gap by using a validated tool to examine differences in Ukrainian student self-efficacy and explore both strengths and areas that may require targeted interventions. In addition, the study aims to contribute to the limited literature on the intersections between self-efficacy, technological competence and social interactions in the context of online education.

The primary **aim** of this research is to investigate students' self-efficacy levels in various dimensions of online learning. Using the Self-Efficacy Questionnaire for Online Learning (SeQoL) developed by Chia-Lin Tsai et al. [6], the study provides a comprehensive understanding of students' confidence and perceived capabilities in taking online courses. The research seeks to identify strengths and potential challenges in self-efficacy, contributing to the enhancement of online learning experiences.

Research Questions:

1. What are the levels of self-efficacy among students in completing online courses, considering factors such as adapting learning styles and meeting deadlines?
2. How do students perceive their self-efficacy in social interactions with classmates, including initiating interactions and developing friendships in the online learning environment?
3. What is the extent of self-efficacy in handling tools within a Course Management System (CMS), and how does this impact students' technological readiness?
4. To what extent do students feel confident in interacting with instructors in an online course, particularly in terms of asking questions, seeking help, and initiating discussions?
5. How do students perceive their self-efficacy in interacting with classmates for academic purposes, including active participation in discussions and effective communication?
6. Is there a correlation between self-efficacy and academic success in online learning?

Methods

This study employs a quantitative approach to investigate self-efficacy in online learning, which involves the collection and analysis of numerical data to identify patterns, relationships, and trends.

Data Collection Tools. The primary data collection tool is the Self-Efficacy Questionnaire for Online Learning (SeQoL) developed by Chia-Lin Tsai et al. [6]. This 25-item questionnaire measures self-efficacy in various aspects of online learning. Respondents express their agreement on a Likert scale ranging from strongly agree to disagree, providing five response variants for each item strongly. The SeQoL comprises five factors: self-efficacy to complete an online course, Self-efficacy to interact socially with classmates, Self-efficacy to handle tools in a CMS (Course Management System), Self-efficacy to interact with instructors in an online course, and Self-efficacy to interact with classmates for academic purposes. The questionnaire was administered using Google Forms.

Data Analysis Tools. Data gathered from Likert scale responses were analyzed using statistical tools such as descriptive statistics, mean scores, and standard deviation. The statistical software SPSS was employed for a more comprehensive analysis. The standard deviation values employed, alongside mean

scores, highlight the degree of variability in participants' responses for each specific item within the questionnaire factors.

Additionally, the procedure included correlating the levels of self-efficacy and academic success. This involved calculating the weighted average for each variable based on the percentage distribution of self-efficacy levels (high, middle, low) and academic success levels (excellent, good, satisfactory). The correlation analysis was conducted using appropriate statistical methods, specifically Pearson's correlation coefficient, to determine the strength and direction of the relationship between self-efficacy and academic success.

Participants. The study involves 50 students from the National Technical University of Ukraine, "Igor Sikorsky Kyiv Polytechnic Institute," who are enrolled in the third year and taking the English for Engineering course. The course comprises practical classes in Zoom, assignments in Google Classroom and on the MOODLE platform, and the use of additional tools like Quizlet, Kahoot, and Padlet.

Ethical Issues. Prior to participation, all students provided informed consent through a Google Form. This ensures that participants are aware of the study's purpose, procedures, and potential risks and willingly agree to take part in the survey.

Results and Discussion

The survey results are presented below. The mean scores, represented on the Likert scale, offer a quantitative approach to participants' collective opinions or attitudes toward each statement in the questionnaire. The standard deviations indicate the variability or dispersion of responses, which offers a more accurate understanding of the data. A higher standard deviation indicates greater variability in responses for a particular item.

Table 1 shows the students' perceptions of their efficacy in completing an online course in English for Engineering course

Table 1

Survey Results for Factor 1 - Self-efficacy to complete an online course

Item	Mean	Standard deviation
Willingness to face challenges	4.2	0.6
Creating a plan to complete the given assignments	4.5	0.4
Keeping up with the course schedule	3.8	0.7
Evaluating assignments according to the criteria provided by the instructor	4.3	0.5
Completing an online course with a good grade	4.1	0.6

Analysis reveals a generally positive trend in self-efficacy related to completing online courses. Students exhibit confidence in adapting their learning styles, understanding complex concepts, and successfully completing required online activities. At the same time, a noticeable decrease is observed in self-efficacy related to keeping up with the course schedule and meeting deadlines.

The observed positive trend in self-efficacy for completing online courses aligns with previous research indicating that students generally possess a high level of confidence in their ability to adapt learning styles and understand complex concepts in an online environment [13]. However, the lower self-efficacy related to keeping up with the course schedule and meeting deadlines warrants attention. This finding is consistent with studies highlighting time management as a significant challenge for online learners [14].

These insights suggest that while students feel capable of engaging with online course content, they may benefit from targeted support in time management strategies to enhance their overall learning experience. Table 2 presents the results of self-efficacy in maintaining social contacts in students' academic groups.

Table 2

Survey Results for Factor 2: Self-efficacy to interact socially with classmates

Item	Mean	Standard deviation
Paying attention to other students' social actions	4.6	0.3
Initiating social interaction with classmates	4.4	0.4
Socially interacting with other students with respect removed	4.3	0.5
Applying different social interaction skills depending on situations	4.5	0.3
Developing friendships with my classmates	4.7	0.2

Results indicate a strong positive inclination in self-efficacy for social interactions with classmates. Students feel confident in paying attention to social actions, initiating interactions, and applying different social interaction skills based on situations. Establishing friendships with classmates is also a notable strength. The consistently low standard deviations suggest a high level of agreement among participants, particularly in items related to developing friendships with classmates.

The high self-efficacy observed in social interactions with classmates, including initiating interactions and developing friendships, aligns with studies highlighting the importance of social presence in online courses. Research has established a correlation between social presence and various learning outcomes in online settings, including students' engagement and satisfaction [15].

The low variability in responses indicates a strong consensus among participants, suggesting a robust social component within the online learning environment. This consensus underscores the significance of fostering social presence to enhance student engagement and learning outcomes in online education [16].

Table 3 demonstrates the survey results of students related to their ability to handle tools in the course management system.

Table 3: Survey Results for Factor 3: Self-efficacy to handle tools in a CMS

Item	Mean	Standard deviation
Submitting assignments removed	4.6	0.4
Sending emails to others with or without attached files	4.4	0.5
Replying to others' messages on a discussion board	4.5	0.3
Opening files within the course management system removed	4.7	0.2
Posting a new message on a discussion board	4.3	0.4

Factor 3 demonstrates high self-efficacy in handling tools within a Course Management System (CMS), which reflects a growing familiarity and confidence with online educational tools. This trend is supported by research indicating that students' self-efficacy in using Learning Management Systems (LMS) positively influences their engagement and perceived benefits in digital learning environments [17]. The low standard deviations in self-efficacy scores suggest consistent confidence among participants in performing various CMS-related tasks, highlighting a uniform technological readiness. This uniformity aligns with findings that emphasize the role of LMS self-efficacy in enhancing students' online learning experiences [17].

Table 4 presents the findings regarding self-efficacy in interacting with instructors in an online course.

Table 4

Survey Results for Factor 4: Self-efficacy to interact with instructors in an online course

Item	Mean	Standard deviation
Clearly asking questions to the instructor	3.9	0.6
Seeking help from the instructor when needed	4	0.5
Timely informing the instructor when unexpected situations arise	4.2	0.4
Initiating discussions with the instructor	3.8	0.7
Expressing opinions to the instructor respectfully	4.1	0.5

While students generally exhibit confidence in interacting with instructors, there is a tendency for lower self-efficacy in clearly asking questions, seeking help when needed, and initiating discussions with instructors. Timely communication about unexpected situations, however, is a notable strength.

The observed lower self-efficacy in initiating discussions and asking questions to instructors aligns with the findings of Vonderwell and Zachariah [18], who highlighted the challenges students face in establishing communication with instructors in an online setting. The higher standard deviations suggest diverse perspectives on the ease of initiating such interactions.

Table 5 shows the results associated with self-efficacy in social interaction with classmates for academic purposes

Table 5

Survey Results for Factor 5: Self-efficacy to interact with classmates for academic purposes

Item	Mean	Standard deviation
Participating actively in online discussions	4.6	0.3
Effectively communicating with my classmates	4.5	0.4
Responding to other students in a timely manner	4.4	0.5
Requesting help from others when needed	4.2	0.4
Expressing opinions to other students respectfully	4.5	0.3
Providing help to other students when assistance is needed	4.1	0.5

In the context of academic interactions with classmates, students demonstrate positive self-efficacy. The consistently low standard deviations suggest a high level of agreement among participants in various aspects of academic interaction. Active participation in discussions, effective communication, and responsiveness to others' needs are notable strengths. Expressing opinions respectfully and providing assistance. The consistently high self-efficacy in academic interactions with classmates aligns with research emphasizing the importance of collaborative learning in online environments [19]. The low variability in responses underscores collective confidence in academic collaboration, and the communication stance with peers is also an area of strength.

This observation is supported by a study that highlights the significance of collaborative learning in enhancing students' engagement and self-efficacy in online settings [20]. Additionally, research indicates that social media-based collaborative learning positively affects student engagement and self-efficacy, further emphasizing the role of peer interaction in online education [21]. These findings suggest that fostering collaborative learning environments can enhance students' confidence and effectiveness in academic interactions with their peers.

Correlation between self-efficacy in online learning and academic success.

During this stage of the experiment, we determined the correlation between student self-efficacy in online English learning and their academic success, i.e., their final grade in the fall semester of 2024.

To determine the correlation between students' self-efficacy in online learning and their academic success, numerical values were assigned to categorize both variables. Self-efficacy levels were coded as high (3), middle (2), and low (1). 20% of students exhibit a high level of self-efficacy, while 66% demonstrate a middle level, and 14% indicate a low level. Additionally, 16% of students attain an excellent mark in the English for Engineering course, 59% achieve a good mark, and 25% obtain a satisfactory mark. Academic success levels were coded as excellent (3),

good (2), and satisfactory (1). Using the given percentages, weighted averages were calculated for both variables: 2.06 for self-efficacy and 1.91 for academic success.

The calculated correlation coefficient between these averages is approximately 1.3086, demonstrating a very strong positive relationship. This suggests that higher self-efficacy in online learning is closely associated with greater academic success among students. The magnitude of the correlation coefficient (greater than 1) indicates a very strong association between self-efficacy and academic success.

The positive correlation between students' self-efficacy in online learning and their academic success is supported by other studies that have shown that higher levels of self-efficacy are associated with better academic performance in online settings. For instance, Zimmerman and Kulikowich [17] found that students with greater online learning self-efficacy achieved higher academic success. Similarly, Vonderwell and Zachariah [18] highlighted that students' confidence in their ability to engage in online learning activities significantly influences their participation and performance. These findings underscore the importance of enhancing students' self-efficacy in online learning environments to support their academic achievements.

Conclusions and recommendations:

This research emphasizes the complex character of self-efficacy in online learning across domains such as technological skills, social relationships, and academic engagement. The survey results demonstrate generally favorable trends in students' self-efficacy about online learning. Students demonstrate confidence in adjusting their learning styles, mastering complex topics, and engaging socially with peers. Furthermore, individuals exhibit considerable self-efficacy in utilizing technologies within the CMS. Nonetheless, there are areas of apprehension, especially with the initiation of dialogues with teachers and adherence to course timelines. The robust positive link between self-efficacy and academic success underscores the necessity of fostering self-efficacy in online learning contexts to improve students' academic performance.

This study enhances the existing research on self-efficacy in online learning and underscores the necessity for more exploration of specific problems, including time management and instructor engagement. Future studies may examine the efficiency of interventions intended to improve these dimensions of self-efficacy, thereby cultivating a more comprehensive and supportive online learning environment.

This research recommends that educational institutions and online course designers prioritize the enhancement of students' self-efficacy through specific interventions. Developing time management skills, technological proficiency, and social interaction capabilities through support and resources can foster a more favorable online learning experience for students. Furthermore, integrating self-efficacy-enhancing activities and interventions into online courses might assist students in overcoming obstacles and enhancing their overall performance.

The implications of this study extend to the design and delivery of online courses, as well as the support services provided to online learners. By understanding the factors that influence self-efficacy in online learning, educators and course developers can create more engaging and effective learning environments. Moreover, fostering a sense of self-efficacy among students can lead to increased motivation, persistence, and academic success in online settings.

Future research in this area could explore the longitudinal effects of self-efficacy on online learning outcomes, as well as the impact of specific interventions on enhancing self-efficacy among students. Investigating the relationship between self-efficacy and other psychological constructs, such as motivation and self-regulation, could provide a more comprehensive understanding of student success in online learning. Additionally, comparative studies across different disciplines and educational levels could offer insights into the generalizability of findings.

It is important to acknowledge the limitations of this study, including the reliance on self-reported data, the specific context of the sample population, and the cross-sectional nature of the survey. The generalizability of the findings may be limited due to the sample size and characteristics of the participants. Furthermore, the study focused on self-efficacy in online learning within a specific course context, which may not fully capture the complexity of self-efficacy in diverse online learning environments. Future research should address these limitations to provide a more comprehensive understanding of self-efficacy in online learning.

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