Journal of Kyzylorda Scholarly Review

P-ISSN:3006-0265 | E-ISSN:3007-4681. Published by the Open University of Kyzylorda
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https://bulletin.ouk.kz/index.php/bulletin/index



SELF-REGULATED LEARNING AND ITS RELATIONSHIP TO COGNITIVE ENGAGEMENT AMONG UNIVERSITY STUDENTS IN THE CONTEXT OF DIGITAL EDUCATION

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Abstract: This study aims to investigate the relationship between self-regulated learning and cognitive engagement among university students in the context of digital education. It seeks to examine the levels of both variables, determine the direction and nature of the relationship between them, and explore potential differences according to selected demographic and academic variables. The significance of this study stems from the increasing shift toward digital learning environments, which provide students with greater autonomy while simultaneously requiring skills in planning, time management, monitoring comprehension, and evaluating performance. The theoretical framework is based on models of self-regulated learning, particularly Zimmerman's model, as well as the literature on cognitive engagement, conceptualized as students' mental effort and strategic investment in learning. The study proposes a descriptive correlational research design involving students from the College of Education at the University of Tikrit during the 2025–2026 academic year. Appropriate measurement instruments will be selected and their psychometric properties verified before administration. Since field data have not been provided, no numerical findings are presented as empirical results. Instead, designated sections and tables are reserved for reporting the actual findings following data collection and statistical analysis. Accordingly, this study provides a comprehensive theoretical and methodological framework that can be completed through empirical investigation, alongside educational recommendations related to digital learning design and the development of self-regulation skills and cognitive engagement.
Keywords: Self-regulated learning, cognitive engagement, digital education, university students.

1. Introduction

There has been an increase in the use of digital platforms, online courses, recorded lectures, online assessments and open education resources in higher education. This transformation has helped to bring more flexible learning opportunities with respect to time and place. But, these opportunities cannot be realized without providing access to educational content. It also requires students to be able to set learning objectives, plan their time, choose the right way to learn, monitor themselves and change their strategy when they have difficulties learning.

The term self-regulated learning (SRL) has been acknowledged as one of the important concepts in Educational Psychology because it sees students as active learners instead of passive recipients of information. Cognitive, metacognitive, motivational and behavioral processes interact before, during, and after a learning task is completed, thus generating this kind of learning. According to Zimmerman (2000), self-regulated learning is a cycle that consists of three phases: forethought and planning, performance and self-monitoring, and self-reflection.

Cognitive engagement, however, is the level of mental effort and cognitive investment that pupils put into their understanding of content, making links between concepts, using deep learning strategies and staying on task in difficult tasks. This is not limited to attending, or being seen, it can be attending a digital learning platform without the student's brain being engaged with the knowledge being processed. Distinguish between this in digital learning spaces is important because distractions are available in abundance and responsibility for students' learning is increased.

Hence, it is crucial to explore the connection between SRL and cognitive involvement among university students in the context of digital education to gain insight into the factors that may correlate with active and deep learning. This investigation might also give a basis for enhancing university teaching practices and for creating digital learning environments which make meaningful learning experiences possible.

2. Research Problem

The research problem is that, the digital learning environments offer students flexibility in learning content, but bring more burden on students, such as setting goals, time management, checking what they learn, resisting distractions and self-assessing learning content. Students' capacities to carry out these processes can vary, and they can also vary in their cognitive involvement in the learning activities.

Hence, the current study aims at understanding the nature of the relationship between self-regulated learning and cognitive engagement in the context of digital education in universities.

The research problem is formulated around the following main question:

What is the nature of the relationship between self-regulated learning and cognitive engagement among university students in the context of digital education?

3.Third: Research Questions

The present study seeks to answer the following research questions:

1. What is the level of self-regulated learning among university students in the context of digital education?

2. What is the level of cognitive engagement among university students in the context of digital education?

3. Is there a statistically significant correlation between self-regulated learning and cognitive engagement among university students in the context of digital education?

4. Are there statistically significant differences in self-regulated learning among university students according to selected demographic and academic variables?

5. Are there statistically significant differences in cognitive engagement among university students according to selected demographic and academic variables?

Fourth: Significance of the Study

Theoretical Significance

This study draws on two basic concepts in educational psychology and explains the possible roles of planning, self-monitoring, and managing one's efforts in the context of mental engagement in digital learning. It also provides an Arabic language theoretical approach which can be used in future research in higher education.

Practical Significance

After collecting and analyzing the data, the actual findings may serve as a guideline in academic counseling program, designing educational activities that encourage learner autonomy and self-reflection, and training students to use time-management and comprehension-monitoring strategies. The study also can help educators to design digital learning tasks that engage students in interpretations, analysis and application, rather than information retrieval.

Fifth: Objectives of the Study

1. The purpose of this study is to find out the level of university students' self-regulated learning and the level of their cognitive engagement, and the relationship between the two factors in the digital learning environment. It also investigates if either construct differs depending on pre-specified demographic and academic attributes for which sufficient data are available and, based on that, it suggests pedagogical implications to enhance both self-regulation and cognitive engagement in digitally mediated higher education.

Sixth: Research Hypotheses

The study assumes that: first, there is a positive and significant relationship between self-regulated learning and cognitive engagement among university students; second, there is a significant difference in the level of self-regulated learning among students in relation to the research variables (gender, grade level, and major); and third, there is a significant difference in the level of cognitive engagement among students in relation to the research variables (gender, grade level, and major). Both latter hypotheses rely on a priori definition of comparison variables, and adequate size of each group for valid testing.

Seventh: Limitations of the Study

- Human Limitations: University students, with the final sample determined according to the sampling procedures and institutional approval.
- Spatial Limitations: College of Education, University of Tikrit.
- Temporal Limitations: The 2025–2026 academic year.
- Subject-Matter Limitations: Self-regulated learning and cognitive engagement in the context of digital learning.

Eighth: Definition of Terms

1. Self-Regulated Learning

Theoretical Definition:

Self-regulated learning is an active process through which learners establish their educational goals, select cognitive, metacognitive, motivational, and behavioral strategies, monitor their progress, evaluate their outcomes, and adjust their behavior in response to feedback (Zimmerman, 2000; Pintrich, 2000).

Operational Definition:

Self-regulated learning is defined as the total score obtained by a student on the self-regulated learning scale adopted in this study, after its suitability and psychometric properties have been verified.

2. Cognitive Engagement

Theoretical Definition:

Cognitive engagement refers to the degree of mental effort and cognitive investment that learners devote to understanding educational material, processing information deeply, employing appropriate learning strategies, and persisting in completing learning tasks (Fredricks et al., 2004; Greene, 2015).

Operational Definition:

Cognitive engagement is defined as the total score obtained by a student on the cognitive engagement scale adopted in this study, after its validity and reliability have been established.

3. Digital Education

Contextual Operational Definition:

Digital education is a way of learning that uses digital platforms, tools and resources to provide learning content, engagement and to complete learning activities and assess. Can be in the form of full online education or blended learning.

Chapter Two: Theoretical Framework and Previous Studies

First: Self-Regulated Learning

The Concept of Self-Regulated Learning

Self-regulated learning does not mean that students learn without instruction or support. Instead, it is their conscious involvement in the regulation of learning processes and the coordination of learning goals, strategies, resources, and learning conditions. Self-regulated learning differs from simply spending long hours studying; its quality depends on the appropriateness of the strategy used for a particular task, the monitoring of comprehension, the response to errors, and the effective use of feedback.

Components of Self-Regulated Learning

Self-regulated learning comprises several interrelated components:

- Cognitive Component: The use of strategies such as summarizing, organizing, elaborating, and connecting new information with prior knowledge.
- Metacognitive Component: Planning, setting goals, monitoring comprehension, evaluating progress, and modifying strategies when necessary.
- Motivational Component: Self-efficacy, task value, expectations of success, and the maintenance of effort.
- Behavioral and Environmental Component: Time management, organizing the learning environment, seeking assistance, minimizing distractions, and utilizing available resources.
- Self-Reflection: Reviewing performance after completing a task, interpreting the reasons for success or difficulty, and using these reflections to inform subsequent planning.

Phases of Self-Regulated Learning

Zimmerman (2000) conceptualized self-regulated learning as an interconnected cyclical process. The forethought phase begins with task analysis, goal setting, and planning. This is followed by the performance phase, which involves implementing learning strategies and monitoring concentration and comprehension. The final phase, self-reflection, involves evaluating outcomes and interpreting performance.

The outcomes of self-reflection influence the subsequent learning cycle. Therefore, self-regulated learning is not an isolated step but an evolving process that

develops through experience.

Self-Regulated Learning in Digital Education

Digital learning environments involve students in multiple decision making processes about their study plan, order of learning resources, time spent with learning content and when to ask for help. Some immediate assessment tools and progress dashboards can make self-regulation easier and notifications, multiple open windows, and unclear instructions can make attention management more difficult.

Therefore, technology only is not a guarantee for successful SRL. The advantages of it will vary with the learning environment design, the skill of the learners and the support provided to them.

Barriers to Self-Regulated Learning

Common barriers to self-regulated learning include:

- Weak planning, poor prioritization, and task procrastination.
- Difficulty estimating the time required to complete learning activities.
- Reliance on rereading without testing comprehension or retrieving information from memory.
- Digital distractions and simultaneous multitasking.
- Limited help-seeking behavior or difficulty using feedback effectively.
- Low motivation or unclear course objectives and success criteria.

Second: Cognitive Engagement

The Concept of Cognitive Engagement

Cognitive engagement is the dimension of learning which deals with the level of mindwork invested by students in education activities. It is seen in the commitment to learning, the use of effective strategies, checking solutions and sticking at the problem when it gets tough. This is about students' quality of thinking, not about whether they are physically in the classroom or logging in on a digital learning platform.

Indicators of Cognitive Engagement

Cognitive engagement can be identified through several indicators:

- Deep Processing: Explaining ideas, comparing information, drawing inferences, and connecting concepts.
- Learning Strategies: Structured summarization, questioning, comprehension testing, and the use of practical examples.
- Mental Persistence: Continuing to work through challenging tasks rather than settling for superficial answers.
- Cognitive Regulation: Selecting strategies appropriate to the task and evaluating their effectiveness.
- Learning Awareness: Recognizing what has been understood and what requires further review.

Distinguishing Cognitive Engagement from Other Dimensions of Engagement

Sometimes, the literature refers to student engagement as a multidimensional phenomenon comprising of behavioral, emotional, and cognitive engagement. The present study concentrates on cognitive engagement, although it is recognized that these dimensions can interact.

Simply attending or joining in with the discussion is not enough to evidence deep cognitive processing. Students can be involved, but not necessarily in meaningful intellectual analysis.

Cognitive Engagement in Digital Learning Environments

Digital learning activities that involve students interpreting the data, solving problems and providing justifiable responses to tasks and engaging in discussion with peers can enhance cognitive engagement. In contrast, content that is just viewed or assessed as memorization may not promote high levels of deep cognitive processing.

Students' cognitive engagement can also be supported by other contextual elements such as the clarity of the interface of the platform, the timing of feedbacks, the availability of learning materials and the teaching presence of the instructor.

Third: The Relationship Between Self-Regulated Learning and Cognitive Engagement

Self-regulated learning is hypothesized to be related to cognitive engagement from a theoretical point of view. With clear goals and self-awareness of understanding, students are in a stronger position to identify areas of learning gaps and focus their efforts there. Likewise, good time management and reducing distractions facilitate more favourable conditions for concentration and reflection helps learners to choose more effective strategies for the next tasks.

However, this theoretical speculation does not mean that the connection is necessary, nor that self-regulated learning is the only source of cognitive involvement. This relationship might be influenced by other factors such as teaching quality, difficulty, motivation and technological conditions.

Based on research on online learning, self-regulated learning is correlated with measures of learning engagement and there may be an interaction between self-regulated learning and instructor presence and social interaction. Miao and Ma (2022) found that some of the factors affecting online learning engagement were positively related to self-regulated learning for university students. In the same way, Doo and Bonk (2020) concluded that the role of self-regulated learning was significant in understanding learning engagement in a university level flipped classroom.

The findings contribute to the significance of examining this relationship on the local education level, and that student engagement, in general, is not synonymous with cognitive engagement only.

Fourth: Previous Studies

1. Study by Doo and Bonk (2020)

This study explored how self-efficacy, self-regulated learning and social presence influenced learning engagement within a large university-level FL classroom. The total number of the participants was 390 students from the university.

The results showed that self-regulated learning was significantly related to learning engagement and social presence. This study is relevant to the present study because it underlined the significance of self-regulatory processes in a Technology supported Learning Environment (TSLE). But the outcome variable is different: here, the study is on cognitive engagement.

2. Study by Miao and Ma (2022)

The study examined the correlation between online student interaction, self-regulated learning, social presence, and learning engagement of 334 university students.

There were positive significant relationships between the results of self-regulated learning with the results of social presence and social presence with learning engagement. There were also some mediating relationships between the variables examined and social presence.

The study also confirms the relevance of considering self-regulated learning in a social and technological learning environment, and not as a characteristic of the

individual alone.

3. Study by Sun and Lia (2022)

This study focused on the relationship between engagement and cognitive load in an online course with immediate feedback and the role of online self-regulated learning in the relationship. There were 35 postgraduate students in the study.

The results indicated that goal setting and task strategies mediated some of the relationships between engagement and cognitive load. Though the study focuses on the importance of regulatory strategies in understanding digital learning experiences, it is important to take into consideration the limited number of students and specific course context in which the study was conducted.

4. Study by Lio et al. (2023)

This study took a repeated-sampling design to examine the relationships between self-regulated learning, co-regulated learning, teaching presence and learning engagement in blended learning environments. The study lasted for 13 weeks and had 139 participants from three universities.

One of the results of this study showed that self-regulated learning was one of the factors affecting cognitive engagement. Other important contextual factors were identified as instructional support and appropriate instructional design.

The results highlight the importance of cognitive engagement in a blended learning setting and its potential connection to both student regulatory processes and quality of the learning environment.

5. Study by Wong et al. (2026)

The present study aimed to investigate the interaction patterns of students with a study application using the mobile device and the relationship between these patterns and self-regulated learning and academic achievement.

The researchers were able to identify distinct patterns of interaction and determined that active engagement was a positive factor in relation to test scores. There was also a relationship between self-efficacy and time management, and academic performance.

The study shows that students are not utilizing the digital learning tools in the same manner and that it is important to consider patterns of technology use to understand learning outcomes.

Academic note: Prior to submission of this chapter for publication, the bibliographic information for the five studies should be checked with the original publications, especially in regard to the names of the authors, the year of publication, the size of the sample, the method of the research, and the findings of each study. This is especially the case for the references Sun and Lia (2022) and Lio et al. (2023), as the information provided is not enough to determine their exact bibliographic identity. I have retained whatever information you have given in your text without adding any information about the publication.

Commentary on Previous Studies

The studies reviewed confirm the significance of SRL in digital/blended learning environments. They suggest that learner characteristics, course design, interaction and instructional support influence learning engagement. The importance of the present study is in the relation of self-regulated learning and cognitive engagement between students of College of Education/ University of Tikrit in the light of the digital education. Results of the local study should be interpreted in the context of the characteristics of the respondents and the instruments used for measurement and the educational environment; they cannot be generalized to all universities.

Chapter Three: Research Methodology and Procedures

First: Research Method

The approach used in the present study is descriptive correlational approach since it is suitable to describe the nature of the relationship between self-regulated learning and cognitive engagement among students in the learning context without manipulation of variables. This design by itself does not allow causal inferences to be drawn.

Second: Research Population and Sample

The target population includes college students in the College of Education at University of Tikrit in the academic year (2025/2026). Stratified random sampling (if possible) with representation proportional to the population of academic year and gender is recommended, following official enrollment statistics from the relevant university authorities.

It was not possible to determine a final population or sample size for the present document due to the lack of official enrollment lists and sampling data.

Table 1: summerize procedures and their detialis in our study.

Procedure	Details Required Before Implementation
Population size	To be completed using official enrollment statistics for the 2025–2026 academic year
Sample size	To be determined through statistical power analysis or an appropriate formula, taking into account the variables and planned analyses.
Sampling method	Stratified random sampling according to academic year and gender is recommended if updated enrollment lists are available.
Inclusion criteria	Students officially enrolled at the college who have been informed about the study and voluntarily agree to participate.
Exclusion of responses	Criteria for incomplete or patterned responses should be established in advance and applied consistently to all participants.

Third: Research Instruments

A self-regulated learning scale and a cognitive engagement scale are needed for the study. Published instruments with proper evidence of validity and reliability should be chosen for university students and permission for use and/or translation should be secured if required.

When a scale is developed or adapted, the process of developing the scale items, expert judgement, and psychometric analysis should be recorded. The mere preparation of a questionnaire does not make up the scientific adequacy of a research instrument.

A. Self-Regulated Learning Scale

The items can cover goal setting and planning, learning strategies, comprehension monitoring, time and environment management, help seeking and self-evaluation.

These are proposed measurement areas and in isolation do not represent a standardized scale. The type of instrument selected should dictate the response options and scoring procedures. If it is applicable, negatively phrased items should be reverse-scored before the total score is calculated.

B. Cognitive Engagement Scale

The items should measure mental effort, deep processing strategies, staying on task with cognitively demanding tasks, and comprehension monitoring while engaging in digital learning.

The instrument chosen should be able to differentiate between cognitive engagement and behavioral/emotional engagement to ensure that there is consistency between how the construct is being measured operationally and how it is being defined for the study.

Fourth: Validity and Reliability

- Face and Content Validity: They should be subjected to a panel of experts composed of Educational Psychologists, Educational Measurement/Evaluation and Educational Technology experts to evaluate the clarity, relevance, and coverage of the intended dimensions. Documentation of expert feedback and item-acceptance criteria should be provided.

- Construct Validity: Can be assessed by item analysis, item-total correlation and (if sample size and data characteristics allow) exploratory or confirmatory factor analysis.

Reliability: Internal consistency can be measured with Cronbach's alpha or with McDonald's omega. But having a high reliability coefficient does not elaborate the validity of an instrument. If appropriate, a subsample can be used to test–retest reliability as well.

Until the validity coefficient and/or reliability coefficient are calculated from actual data, do not report them.

Fifth: Data Collection Procedures

The study will follow these procedures:

1. Obtain the necessary administrative and ethical approvals before contacting students.
2. Explain the study's purpose, the voluntary nature of participation, and the confidentiality of the data, while avoiding the collection of unnecessary personal identifiers.
3. Conduct a pilot study to assess the clarity of instructions, completion time, and suitability of the items.
4. Administer both instruments in paper-based or electronic form, maintaining consistent instructions and conditions as far as possible.
5. Examine the dataset for missing values and invalid responses according to predetermined criteria.
6. Code and statistically analyze the data, then present and discuss the actual findings in light of the theoretical framework and previous studies.

Sixth: Statistical Methods

The following statistical methods may be used, depending on the research questions and the characteristics of the data:

- Arithmetic means and standard deviations to describe students' scores.
- Pearson's correlation coefficient when its assumptions are satisfied, or Spearman's rank correlation coefficient when the assumptions required for Pearson's correlation are not appropriate.
- The independent-samples t-test when comparing two independent groups, or analysis of variance when comparing more than two groups, with nonparametric alternatives used when necessary.
- Confidence intervals and effect sizes, alongside statistical significance values, whenever possible.
- Appropriate reliability coefficients, item analysis, and construct-validity procedures

according to the measurement instrument and sample size.

The choice of statistical test should be based on the level of measurement, data distribution, and independence of observations rather than simply on the popularity of a particular test.

Chapter Four: Presentation and Discussion of Results

Important note: The numerical values below are kept from the provided draft as examples. They should not be conveyed as real research results until they have been checked against the original set of data and statistical analysis.

Table 1: Results for Research Question One — Level of Self-Regulated Learning

Variable	Sample Size	Mean	Standard Deviation	
Self-regulated learning	200	74.60	10.80	Moderately high, according to the scale's criteria

The illustrative values have a mean of 74.60 and a standard deviation of 10.80 for a sample of 200 students. The interpretation of the level should be made based on the criteria for scoring that have been determined for the instrument that has been chosen. Hence, the description given here is preliminary and subject to interpretation levels set by the scale.

Table 2: Results for Research Question Two — Level of Cognitive Engagement

Variable	Sample Size	Mean	Standard Deviation	
Cognitive engagement	200	74.60	10.80	Moderately high, according to the scale's criteria

The numbers in this table are representative and should be substituted with the actual descriptive statistics collected on the cognitive engagement scale.

Table 3: Results for Research Question Three — Relationship Between the Two Variables

First Variable	Second Variable	Correlation Coefficient	Significance Level	Sample Size	Interpretation
Self-regulated learning	Cognitive engagement	0.58	p less than 0.001	200	Moderate-to-strong positive and statistically significant correlation

The illustrative result shows that the self-regulated learning and cognitive engagement have a correlation coefficient of 0.58 and the significance level is less than 0.001. In this case, the scores of self-regulated learning and cognitive engagement are directly related, with higher self-regulated learning scores

corresponding to higher cognitive engagement scores. But the correlation on its own doesn't imply a cause and effect relationship between the variables.

Table 4: Differences According to Demographic Variables

Dependent Variable	Comparison Variable	Test	Statistic	p-value	Conclusion
Self-regulated learning	Gender	Independent-samples t-test	t = 1.12	0.264	No statistically significant difference
Cognitive engagement	Gender	Independent-samples t-test	t = 0.86	0.391	No statistically significant difference

These values are illustrative. The final conclusions should be based on the actual group statistics, degrees of freedom, significance levels, and effect sizes calculated from the study data.

Fifth: Discussion of Results

The positive relationship shown above is in line with the theoretical orientation suggesting that goal setting, comprehension monitoring and time management can contribute to increasing the mental effort of students in doing educational tasks. This relationship may also be supported by feedback and digital learning activities that need to be analysed and interpreted.

However, correlational results do not lend themselves to clear conclusions about cause and effect. Besides, a representative sample and measure instruments with appropriate psychometric properties should be used to make the results generalizable.

Chapter Five: Conclusions, Recommendations, and Suggestions for Further Research

First: Conclusions

As indicated by the illustrative figures in the draft, there is a positive relationship between self-regulated learning and cognitive engagement while there are no significant differences between males and females in either variable.

All conclusions are tentative until actual data may be analyzed and the conclusions verified. It is only then that they can be attributed to students of the College of Education/ University of Tikrit.

Second: Recommendations

Based on its results, the study suggests that short and focused training courses on goal formulation, task planning and time management should be integrated in digital courses, and that courses should be developed online in which students are required to interpret, analyse, compare and solve problems rather than just recalling information. It also highlights the importance of providing direct and timely feedback to students, along with suggestions on how they can use it to adapt their learning strategies, and ensuring that online tools are designed to track student progress and reflect actual learning, rather than the number of logins or hours spent online. In addition, students need to be more aware of strategies to limit digital distractions and to organize their learning environment, and teachers must be empowered to acquire the skills necessary to create digital learning activities that promote deep thinking and active mental engagement. Finally, these recommendations must be prioritized and implemented according to the empirical findings from the study in line with the needs of the students identified by the study.

Third: Suggestions for Further Research

The following suggestions may guide future research:

1. Conduct a longitudinal study to examine changes in self-regulated learning and cognitive engagement throughout an entire academic semester.
2. Investigate the effectiveness of a training program designed to improve self-regulated learning and enhance cognitive engagement using a quasi-experimental design.
3. Compare the relationship between the two variables across face-to-face, blended, and fully online learning environments.
4. Examine the potential roles of self-efficacy, academic motivation, and teaching presence in the relationship between the two variables.
5. Use digital learning analytics alongside questionnaire data to gain a more accurate understanding of self-regulatory learning behaviors.
6. Conduct further studies across different university colleges and academic disciplines to assess the extent to which the findings can be generalized.

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