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# Assessment of metacognition and self-regulation of students in the context of online learning

**Abstract.** *The article is devoted to the evaluation of two characteristics - metacognition and self-regulation of students in online learning. The development of metacognitive skills in the context of online learning is one of the priority areas of research in educational psychology, as it is closely related to the skills of self-regulation of educational activities.*

*Due to the increasing relevance of distance learning, it is possible to study these indicators during the pandemic, in an online environment. In this regard, the purpose of this article is to determine how the metacognition level of students interacts with self-regulatory skills in the conditions of online learning and the identification of features and patterns between the two concepts in the psychological and pedagogical literature. The design of the study was carried out through a quantitative study conducted via the Internet. To conduct the experimental part of the study, an online survey through a self-report questionnaire was conducted among 48 students at Kazakh National university through Google forms using a Metacognitive awareness inventory and an Online self-regulated learning questionnaire. As a result of the experiment, it was revealed that metacognition level is correlated with self-regulated learning level. Similar dynamics of students ' responses to metacognition and self-regulated learning were revealed. Consequently, metacognition skills determine whether students are independent in their learning and how to regulate it. Due to the constant high percentage of positive responses, it can be stated that the online educational environment stimulates the development of metacognitive qualities and self-regulation skills of students.*

**Keywords:** *higher education; metacognitive skills; self-regulatory learning; online educational environment; distance learning.*

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## Introduction

The term metacognition consists of two roots-the words cognition-meaning knowledge, cognition, cognitive ability, and meta in the theory of knowledge meaning - «about yourself», which forms the meaning - knowledge about cognition, reflection about thinking, thinking about own thinking. Sometimes without realizing it, we produce certain metacognitive actions in our thinking, which are systematized into our metacognitive experience. Metacognitive experience is an individual experience about the process of one's thinking, which is most often consciously perceived but can also be unconscious, or automatic. At first glance, the seemingly complex term is quite simple in its meaning. Each of us has experience with

metacognitive thinking, for example, in an educational environment, even in school. These are our reflections on the peculiarities of our thinking in general, the intellectual thinking of other people around us, the student's reflections that he is strong in or weak in learning, the comparison and self-assessment of the student's success in various disciplines, all of this - metacognitive reflections, a kind of monitoring of mental activity, ideas about our thinking formed through our metacognitive «knowledge» experience, and then carrying the function of regulation over our actions, intellectual and mental. In educational research in the context of Kazakhstan, there is a gradual increase in interest in metacognitive processes, as defining and fundamental from the standpoint of pedagogical psychology [1, 2].

The metacognitive competence development strategy is a new approach to teaching and learning in Kazakhstan, also interpreted by Sinitsyna as «helping students to become aware of their understanding and willingness to take responsibility for their own learning in such a way that they can continue to learn independently» [3]. Kazakhstan authors interpret metacognition, and meta-competencies as new qualities necessary for learning to form a person «capable of creative thinking, acting, and self-development» [5]. Thus, the need for conducting metacognitive research in the Kazakh environment is growing and determines the relevance of this study.

Self-regulatory learning has a similar nature to metacognition. This is the students' self-organization of the educational process, the independent ability to allocate their resources for learning, and the ability to use them in a suitable situation. Students need maximum flexibility in the learning process: it is not enough to acquire only professional skills and competencies, individuality, independence, and the ability to adapt to rapidly changing environmental conditions – components of self-regulation in learning. Self-regulation in the performance of tasks, effective organization, and planning of educational work, adaptation of their skills, and independent and responsible educational decision - making is necessary components for learning.

The development of metacognitive skills and self-regulation in the educational process is particularly important in the context of non-traditional forms of the educational process, such as online learning. In the conditions of 2020, online learning has become inevitable, generally accepted, and ubiquitous. Expansion of spatial learning opportunities; online connection from the most diverse places of presence; significant savings in time and financial resources spent on the road; the opportunity to use a wide variety of digital network tools; detachment from the live process of communication with people; complete dependence on electronic in learning and many others are the current features of the educational process. Globally this is a new experience in the field of education, requiring study and consideration from various angles.

In online learning environment interaction between student and instructor differs from face to face and develops in other tendencies. Interactional features of the process are important for our topic. Instructor contact with the student through virtual instruments and has no opportunity to observe and control his activities fully. The student is forced to be more independent than in a traditional learning environment. In such conditions, he is more flexible to use individual learning strategies because less controlled by the instructor. It creates an opportunity for the development of individuality in learning which allows us to consider this environment from the standpoint of metacognition and self-regulation. Temporary change of the usual traditional learning environment for a long-term period forced almost every student to consciously or unconsciously gather experience that was not previously required for learning. Hence, a new learning environment with its peculiarities has formed around the student in the operation of metacognitive perception and comprehension.

Accordingly, the theoretical background of this article is based on constructs of metacognitive theories which were developed at the end of the last century, and educational investigations of self-regulation in learning. The online educational environment during a pandemic will be the focus of the review of these concepts.

The goal of our paper is to assess and analyze the situational metacognition and self-regulated learning indicators of students in an online learning environment. The level of metacognitive awareness is often compared and considered a prerequisite for high academic performance. We consider it more appropriate to observe metacognition as a predictor of high-level self-regulatory learning skills and propose that metacognition correlates to self-regulation indicators.

**Methodology**

Our research design is characterized as quantitative internet-mediated research.

Questionnaire development process. There are methods for measuring, assessing metacognition, and self-regulated learning that are already considered traditional at the time of our study.

To identify individual metacognition levels that arise among students we use a traditional self-report instrument – MAI - Metacognitive Awareness Inventory by Schraw and Dennison in the reduced version which consists of a 19-item subset for between-group comparisons developed by Harrison and Vallin [6].

The second instrument selected dedicated to measuring self-regulated learning is OSLQ – Online self-regulated learning questionnaire. The results of the study conducted by Barnard and the research group indicate evidence of the reliability and validity of the OSLQ to assess the self-regulatory learning skills of students enrolled in both blended and online course formats [7].

The questions were translated into Kazakh and Russian from English. During the translation, some questions were adapted to the Kazakhstan educational environment and context. For instance, one question was inappropriate - I choose a time with few distractions for studying for my online course. This question is not appropriate for online classes during a pandemic in the Kazakhstan context, which is held according to the schedule. However, this question has been adapted and defined as the time that is allocated for completing tasks at home. Also, the term regular classroom was adapted and translated as traditional learning, which is more understandable for local students.

A phrase during online learning was added to each question of MAI. For answers, we use 5-point Likert-type response scales (fully characterizes me; characterizes me; find it difficult to answer; does not characterize me; does not characterize me at all).

**Literature review**

**A short analysis of the interaction between metacognition and self-regulated learning.** Metacognition and self-regulation are some of the most profound spheres in the scope of study of educational psychology. American developmental psychologist Flavell J.H. coined the term metacognition for the first time in the context of education by presenting a model of metacognitive monitoring, comprising of a) metacognitive knowledge b) metacognitive experience c) metacognitive goals, and objectives d) metacognitive actions and strategies [8]. The scientists further developed a concept because ideas about thinking formed metacognitive knowledge and carry the function of regulating learning. «Self-regulation grew out of this definition when the metacognitive term separated into knowledge about cognition (monitoring) and self-regulatory mechanisms for checking the outcome, planning, monitoring effectiveness, testing, revising, and evaluating strategies» [9]. Schraw G., and Moshman D. present a coherent and logical picture of metacognitive theories with the view of scientific classification. Metacognitive knowledge was determined as knowledge about cognition, that person knows about own cognitive abilities and cognition in general. The second component - metacognitive regulation includes skills - planning (for example, forecasting and regulating learning strategies before it begins), monitoring (understanding and awareness during the implementation of a learning task, a good example is the ability to periodically check yourself during training, evaluation (for example, re-evaluating learning goals and conclusions). The regulation component is interesting in the terms of metacognition and self-regulated learning [10].

In our topic, we consider self-regulation as a concept directly related to learning. The term self-regulated learning is implied to a greater extent by the actions of the student, which are manifested in learning skills, abilities, and habits. «Students must actively plan their work, set goals, and monitor their comprehension and the time they spend on learning. These activities can together be defined as self-regulated learning (SRL)» [11].

The description of the relationship between metacognition and self-regulated learning remains an open question and is determined by different conditions. What is the correlation between the two parameters?

Azevedo R. drew the attention of science to theoretical, conceptual, methodological, and instructional issues existing between metacognition and self-regulated learning [12]. In common, the boundaries between these concepts are not strictly defined. The nature of the issues discussed and even research tools of metacognition and self-regulated learning are quite close, up to the blurring of boundaries between them, combining into one construct. There are several interactional models between the two categories: when one of the constructs is subordinate to the other; the case in which self-regulation is associated with the regulatory functions of metacognition; the latest when metacognition is an integral part of self-regulation construct [13]. The discussion on variations of the metacognition and self-regulatory learning constructs becomes of fundamental importance for the educational psychology sphere. The review of Fox and Riconscente consume that according to James, Piaget, and Vygotsky «neither subsumes nor subordinates the other» implying metacognition and self-regulation «where one stands as a reflection or consequence of Self (for James), a knowledge of others and objects (for Piaget), or to the use of language (for Vygotsky) [14].

A careful analysis of concepts suggests that metacognition, self–regulation, and self-regulated learning are associated with the relationship of «nesting» or «overlap», but the roots of metacognition lie in cognitive theory, while researchers of self-regulation are followers of neo-behaviorism [15]. The paradigm in which metacognition is a sub-component of the inclusive construct of self–regulated learning is supported by some authors [16, 17]. According to them, self-regulated students use different strategies for learning, including metacognitive, to handle the process of education [18]. Our position is that metacognition is a broader concept than self-regulatory learning and includes self-regulation of learning activities as one of its functions. Even though the main function of metacognition is the regulation of educational activity, it is also important for teachers as a teaching tool, it is a source of self-determination of educational qualities, and psychological and intellectual characteristics, required for learning.

**Online learning during the pandemic.** Generally, online learning was developed due to digital, electronic, and Internet technologies, developing and spreading at a very fast speed. By the time the pandemic began, online learning, previously elaborating synergistically in the university environments, its elements, pedagogical methodology, and digital tools, had become a ubiquitous basis for learning regardless of the level of organizational readiness. Distance learning and the online educational environment are likely to become more popular in the post-quarantine world [19]. What are students' notions about online learning? Studies approve, that preliminary perceptions of students towards online education in distance learning are focused on accessibility and presentation rather than pedagogical techniques and interactivity [20]. Students are aware of the different problems in the learning process during the pandemic. Foreign authors detect the students' interest in maintaining their studies remotely or at a distance. It turned out that this interest is inversely linked to the several individual difficulties inherent to own students, including the lack of internet access and low skills to use ICTs and applications [21].

Research conducted in 2017 evidence that graduate students have more vigor to engender personal values in the given online learning activities and to implement tasks developing

their competence while undergraduate students perceive a strong need to eschew divulging incompetence compared to other classmates [22].

Summarizing two bases for the article, students' metacognitive and self-regulative skills are played a significant role in online courses and computer-based learning [23, 24].

In the study of metacognition in an online community, Akyol and Garrison defined metacognition in an online learning community as «the set of higher knowledge and skills to monitor and regulate manifest cognitive processes of self and others» [25].

Thereby, to some extent unique currently established online learning environment activate the development of certain observations in students, the assessment of which represents the purpose of research. Our study is focused on the following question: What is the correlation between metacognition and self-regulated learning in the online learning environment?

**Results and discussion**

The procedure was administered through Google forms. Students received no compensation for their participation. 48 participants were asked to express their relation on 43 questions in total. The scale was administered at the end of the first semester, students have already collected some experience and had the opportunity to reflect on it and evaluate their learning process. Participants were informed about the voluntary nature of the study and the confidentiality of their responses. The survey was conducted remotely, so we obtained consent to participate in the study through incorporating the form question.

In total, 18.8% (n = 9) of the participants were males, while 81.3% (n = 39) were females.

The study was conducted among undergraduate students of the Faculty of History of the Kazakh National University. Participants were enrolled in degrees such as Scientific history, Archeology, and Ethnology, Museum studies and protection of monuments, Archival studies, records management and documentation support, and Library studies. The most common learning platform among students was the ZOOM program. It is important to note that the online environment implied by this article is specific and connotes learning through video-conference applications, undertaken with teaching students during the pandemic in the context of Kazakhstan. With such conditions, the disciplines were distributed for lectures, and practical classes. Also, there was a constant schedule and a system of assessment that did not differ from the traditional one. The use of online tools was aimed at the possibility of contactless interaction.

**MAI results**

Students' metacognitive qualities were assessed by a Metacognitive awareness inventory. This test evaluates the following indicators:

1. Knowledge about cognition, the components of which are:

Declarative knowledge – the basis of metacognitive ideas, and views about oneself and others.

Procedural knowledge – knowledge about how a particular activity is performed.

Conditional knowledge – knowledge about when to apply a particular strategy.

2. Regulation of cognition, the components of which are:

Planning: information management strategies, comprehension monitoring, debugging strategies – meaning the correction of errors and strategy selection and evaluation – ability to evaluate learning outcomes

Declarative knowledge - knowledge about skills, intellectual resources, and abilities as a learner was represented in four questions. Comparatively, the largest number of students know what kind of information is most important to learn, among negative values - the largest number of students do not consider themselves a good judge of how well they understand something.

Two items on procedural knowledge – I am aware of what strategies I use when I study and I find myself using helpful learning strategies automatically produced response ratios with similar values: does not characterize me at all

2.1%/2.1%; fully characterizes me-18.8%/16.7%. Two questions of planning - knowledge about how to implement learning procedures- detect that students prepare tactics before they start working. The presence of a monitoring strategy for the understanding of important relationships was noted by 39.6 percent of students, also 29.2 % are sure that this item fully characterizes them. The answers to the two questions contained on the use of evaluation strategies correlate with positive responses (52.1% and 50 % 25% and 16.7%). The most successful IMS – information management strategy among students was translating new information into their own words, while item I ask myself if what I am reading is related to what I already know collected the largest number of negative responses. On average, about 68.7 % of students confirmed that the use of debugging strategies was typical for their learning – most often this means that if a student has difficulties with learning, he will ask for help from a groupmates or a teacher.

**OSLQ results**

OSLQ evaluates such components of self-regulatory learning as goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation.

The item I set short-term (daily or weekly) goals, as well as long-term goals (monthly or for the semester), had the highest number of positive responses, while the item I don't compromise the quality of my work because it is online – the lowest number of positive responses in the goal-setting category. Two questions in this category had the same percentage of positive responses. Students also found it difficult to answer the question I don't compromise the quality of my work because it is online. According to the self-report finding a comfortable place to study is the most popular strategy among students in the Environment structuring category. Two questions in the section have the same percentage of negative answers. 47.9 percent of students noted that taking more thorough notes for online courses characterizes them, and the same percentage of students prepare questions before joining in the chat room and discussion. Among all items, the most "unpopular" among students is the strategy of getting help from the instructor (teacher) through e-mail in the Help-seeking category.

Thus, students turned out to be the most inclined to positive answers, more often choosing the option that item characterizes them, or characterizes them completely. (Table 1). Regarding the implications of this study, the self-report questionnaire is based on the student's judgment about himself. In the condition of the pandemic this assessment type turned out to be convenient and suitable, but it may contain inaccuracies and errors because all of the information gathered is subjective assessments by the students themselves. Students may be wrong in their judgments about whether they perform certain activities regularly.

| **MAI results** | | |
|---|---|---|
| find it difficult to answer | 159 | 17,4% |
| does not characterize me at all | 18 | 2,0% |
| characterizes me | 424 | 46,5% |
| does not characterize me | 80 | 8,8% |
| fully characterizes me | 231 | 25,3% |
| | 912 | 100,0 |

| **OSLQ results** | | |
|---|---|---|
| find it difficult to answer | 217 | 18,8% |
| does not characterize me at all | 7 | 0,6% |
| characterizes me | 536 | 46,5% |
| does not characterize me | 137 | 11,9% |
| fully characterizes me | 255 | 22,1% |
| | 1152 | 100,0 |

**Table 1.** Results of MAI and OSLQ

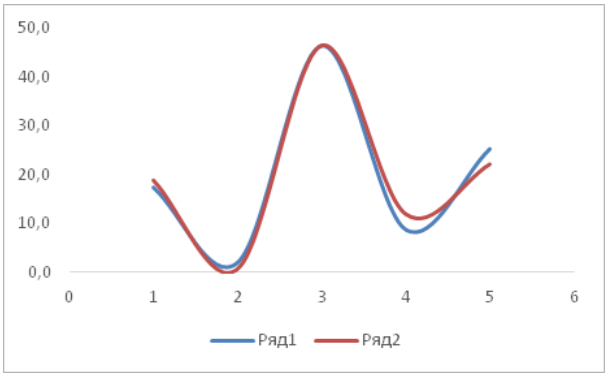

**Table 2.** Correlation between assessment results

| | | |
|---|---|---|
| 17,4 | 18,8 | 0,989958 |
| 2,0 | 0,6 | |
| 46,5 | 46,5 | |
| 8,8 | 11,9 | |
| 25,3 | 22,1 | |

**Conclusion**

A hypothesis suggesting a positive correlation between metacognition and self-regulated learning has been confirmed (Table 2). Due to the constant high percentage of positive responses, it can be stated that the online educational environment stimulates the development of the metacognitive and self-regulated learning skills of students.

Thus, the development of metacognitive skills in the university environment is a universal tool with which the student will learn to be more independent and regulate the educational process. In the context of distance or blended learning, this is also relevant. Society needs educated people who can make their own decisions in a situation of choice, who have a sense of responsibility for learning, and who are able to constantly adapt to the rapidly developing forms of education, in this regard, metacognition and SRL appears as a tool. Students need maximum flexibility in the learning process: it is not enough to acquire only professional skills and competencies, the humanization of education develops students' individuality, independence, and the ability to adapt to rapidly changing environmental conditions. Thus, the ability to quickly adapt to the specific conditions of study at the university - self-regulation in the performance of tasks, effective organization and planning of academic work, the ability to adapt and maneuver their skills and knowledge use skills may well develop into an equivalent ability in the conditions of professional work, to teach to act independently and responsibly.

Since the research was focused on assessment, we conclude that further research in this direction requires the creation of metacognition measurement tools specifically tailored for online and blended learning environments. Also, the existing assessment tools are not always «in tune» with the Kazakhstan educational environment, and its features, so it is important to develop such tools in the domestic educational environment.

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**Онлайн оқыту жағдайында студенттердің өзін-өзі реттеуі және метатанымын бағалау**

**Андатпа.** Мақала онлайн оқыту жағдайында студенттердің екі сипаттамасын - өзін-өзі реттеуі мен метатанымын бағалауына арналған. Метакогнитивті дағдыларды дамыту білім алушылардың оқудағы өзін-өзі реттеу дағдыларымен байланысты, сондықтан бұл бағыт педагогикалық психология шеңберінде зерттеліп жатқан өзекті ғылыми бағыттардың бірі. Қашықтықтан оқыту формаларының өзектілігінің артуы осы индикаторларды пандемия кезінде онлайн оқыту барысында зерттеуге мүмкіндік береді. Осы мақаланың негізгі мақсаттары - пандемия кезіндегі онлайн оқу барысында метакогнитивті деңгейдің өзін-өзі реттеу дағдыларымен байланысын анықтау, психологиялық педагогикалық әдебиеттерде терминдер арасындағы өзара байланысты анықтау. Мақала жазу барысындағы зерттеу дизайны сандық

әдістер және интернет арқылы жүзеге асырылды. Зерттеудің эксперименталды бөлімін өткізу мақсатында Қазақ Ұлттық университетінің 48 студентінен Google forms арқылы метакогнитивті дағдыларды ұғыну және онлайн оқудағы өзін-өзі реттеу қасиеттерін анықтау мақсатында сауалнамалар жүргізілді, сол инструменттер арқылы студенттердің метакогнитивті және оқудағы өзін реттеу дағдылары анықталды. Эксперимент нәтижесінде, метакогнитивті деңгей мен оқудағы өзін-өзі реттеу деңгейлерінің өзара корреляциясы анықталды. Метатанымның және оқудағы өзін-өзі реттеу сұрақтарына студенттер ұқсас жауаптар берді. Алынған нәтижелер бойынша, метатанымдық қасиеттердің даму деңгейі студенттердің оқуда өзіндік оқу стратегияларын жүзеге асыруын, дербес болуына ықпал етеді. Зерттеу нәтижесін қорытындылай келе, студенттер арасында оқуда белгілі бір стратегияны пайдаланатындығын белгілейтін, метатанымдық қасиеттерін анықтайтын жауаптардың проценттері тұрақты түрде жоғары болғандықтан, онлайн оқу ортасы метакогнитивті қасиеттердің және оқудағы өзін-өзі реттеу дағдыларының дамуын ынталандыратындығын мәлімдей аламыз.

**Түйін сөздер:** жоғары білім беру, метакогнитивті дағдылар, оқудағы өзін-өзі реттеу дағдылары, онлайн оқыту ортасы, қашықтықтан оқыту.

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**Оценивание метапознания и саморегуляции студентов в условиях онлайн-обучения**

**Аннотация.** Статья посвящена оцениванию двух характеристик - метапознания и саморегуляции студентов в условиях онлайн-обучения. Развитие метакогнитивных навыков в условиях онлайн-обучения – одно из приоритетных направлений исследования в педагогической психологии, так как оно тесно связано с навыками саморегуляции учебной деятельности обучающихся. В связи с нарастанием актуальности дистанционных форм обучения представляется возможность изучить эти показатели во время пандемии, в онлайн среде. Целью данной статьи является определение того, как уровень метапознания студентов взаимодействует с уровнем учебной саморегуляции в условиях онлайн-обучения, выявление особенностей и закономерностей между двумя понятиями в психолого-педагогической литературе. Дизайн исследования был осуществлен через количественное исследование, проведенное посредством сети Интернет. Для проведения экспериментальной части исследования был проведен опрос посредством двух тестов самоотчета – Опросника метакогнитивной осведомленности и Опросника саморегулятивных навыков в онлайн обучении - среди 48 студентов Казахского национального университета (через Google forms для исследования метакогнитивных и саморегулятивных навыков в обучении). В результате эксперимента было выявлено, что уровень метапознания коррелирует с уровнем саморегулируемого обучения, была выявлена схожая динамика ответов студентов по метапознанию и саморегулируемому обучению. Метапознавательные навыки определяют то, насколько студенты самостоятельны в учебном процессе и осуществляют регуляцию познавательной деятельности. Основываясь на высоком проценте положительных ответов в тестах самоотчета среди студентов, можно констатировать, что онлайн-образовательная среда стимулирует развитие метакогнитивных качеств и навыков саморегуляции студентов.

**Ключевые слова:** высшее образование, метакогнитивные навыки, саморегулятивное обучение, онлайн образовательная среда, дистанционное обучение.

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